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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

The Present State of the Livestock Industry in Algeria

by G. TROUETTE

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On account of its topography, its configuration and its limits, the sea at the north and the desert at the south, Algeria shows various climatic conditions and distinct zones that have limited the distribution of its animal population.

In the Sahels zone, a region of hills extending along the mediterranean shore, all the domestic animals are found together.

The region of low plains (Mitidja, Macta, Bône) formerly supported numerous cattle which have been driven by vine-growing towards more elevated land (Mina, Eghriz, Ain-Bessem, Sétif, Constantine, Guelma). These plains, from 1900 to 3250 metres in altitude, include the best centres for breeding horses and mules, and during the summer, provide food for the great part of the migratory flocks of sheep, driven by the drought and heat of the season from the real high plateaux.

The latter form steppes, with an irregular and scanty water supply and whose clayey-sandy soil supports a dwarf and shrubby vegetation suitable only for the food of sheep and camels.

The woods in the mountains overlooking both low and high-lying plains, provide shelter for the major part of the flocks of goats.

Over an area of 50 million hectares are spread about 15 million head of livestock. At present rates they represent about 500 million francs.

The importance of these figures is considerably diminished on noting that over an equal area in France in 1913 were spread 46 million animals worth over 5000 million francs, and that each sq. km. of the capital supported 12,083 kg. of domestic animal matter while the Algerian soil only supported 1,544 kg.

If France and Algeria may be compared as to their surfaces, they can neither be compared as to other agricultural subjects, nor as to their methods of breeding.

Great differences also exist between the forage resources of the metropolis and Algeria; in the former abundant and varied, in the latter almost uniform.

The natives keep the greater part of the livestock and possess 10 times more domestic animals than the Europeans.

Animals in 1913.

	to Europeans	belonging to Natives	Totals
Horses	61 866	154 179	216 045
Mules	57 502	137 231	194 733
Donkeys	8 627	262 878	271 505
Cattle	170 108	937 485	1 107 593
Sheep	772 014	8 038 725	8 810 739
Goats	89 599	3 758 202	3 847 801
Pigs	111 995	15	112 010
Camels	240	184 578	184 818
Totals . . .	1 271 951	13 473 293	14 745 244

This fact alone suffices to explain that breeding in Algeria is not so developed as the same industry in Australia and South America, even if not considering the advantages of environment, which are more suitable to stock rearing in the latter countries than in Northern Africa.

In fact, numerical development is closely related to hygiene and feeding. Thus, if one finds the Algerian colonist well provided with suitable housing and sufficient reserve food to enable him to tide his animals over the bad season, it is by no means so with the native. The latter, faithful to the maxim that "Allah who created me, protects me", provides neither shelter nor reserve food for his livestock. The rain and the temperature contro the condition of his flocks and herds. If the winter is severe or there is a lack of water, the animals die in great numbers through cold and hunger. If, on the other hand, rain is plentiful and the winter mild for several years, pasturage is not wanting and the herds increase; but only one year of dearth is required for the herds to decrease, while several years of abundance are necessary to make good the loss.

The livestock belonging to Europeans increases regularly, while that of the natives remains more or less stationary.

	Animals belonging	
	to Europeans	to Natives
in 1890	594 590	13 834 828
in 1900	725 723	12 497 877
in 1910	1 041 990	13 716 502

The improvement of the native breeds is hindered by the majority of Mussulmen because of their fatalistic indifference which can not be overcome, even as regards the horse, an animal for which the Koran imposes affection as a religious duty. Yet, in some few regions under the influence of the administrators and the contagious effect of example, the natives have made some progress in animal husbandry.

In addition, the improvement of the domestic animals belonging to the European colonists has long been retarded by forgetting the influence of environment and feeding, disregard of the laws of heredity, unthinking belief in prejudices, occasionally too by the severe effects of contagious diseases, not understood and lacking specific treatment.

Such as they are, the domestic animals and their products occasion transactions which, in 1913, by reaching a total of 88 million francs, have gained the second place in the export trade of Algeria. Out of that sum, 72 millions represent the share of France, 7 million those of foreign countries, while 10 millions result from exports to Morocco and Tunis.

The imports of livestock are smaller; the value, in 1913, amounting to 18 million francs.

On simply examining these commercial statistics, one would be tempted to conclude that the condition of the livestock industry in Algeria is in a good condition. But if it is remembered that the imports are principally milking and working animals, and fresh and prepared food, it is seen that Algeria lacks good working animals, deep milkers, and at certain periods at least, food for consumption.

The inference is correct, and leads to the examination of each species of Algerian domestic animal, of their defects and qualities, and to an account of the usual methods or those to be used in order to minimise the former and increase the latter.

HORSES. — The Algerian horse is usually described as the *Barbary* horse. Riders blame it as having a rather heavy head, flabby cruppers, thin thighs, flat sides, bunched-up legs, an ugly and short step. They forget its strong back and withers, its deep chest, its fine clean legs, and also its courage, vigour, simple habits and endurance, which make it the finest cavalry horse in the world. — Growers and carting contractors justly say that the Barbary horse is not a quiet worker and lacks the strength and weight needed for continuous effort. Its improvement is thus required, but in different ways, by all those using it.

Export of livestock and their products in 1913.

	No. of Head.	Value in fr.		Quintals (1)	Value
Horses	3 433	1 341 000	Fresh meat . .	68	11 000
Mules	1 755	1 053 000	Salted " . . .	1 185	167 000
Donkeys	3 535	159 000	Pork, etc. . . .	161	53 000
Cattle	44 711	10 039 000	Fats	2 607	266 000
Sheep	1 190 348	40 796 000	Raw Skins . . .	51 936	10 777 000
Goats	2 147	43 000	Wools	97 892	13 195 000
Pigs	8 246	927 000	Various	21 248	458 000
		63 318 000			24 927 000

Total Value . . . 88 245 000 fr.

Breeders wishing to improve its shape and size have, after some trials, settled upon the Breton stallions, whose temper, simple habits, endurance, compact form, combine perfectly with the qualities of the native race.

The chief regions occupied in this industry are Philippeville, Sétif, Batna, Mitidja, Tlemcen, Triaret. The results of experiments have given encouraging results.

MULES. — This industry uses about 20 000 mares in Algeria. They are mated with either native jacks or those occasionally imported from Poitou, more often from the Pyrenees, Catalonia or Savoy. The districts of Sétif, Constantine, Tlemcen and Oran produce the most mules. This industry gives quicker and surer returns than those obtained in horse-breeding. Besides, the demand and prices offered for mules are continually increasing. Thus the natives are devoting themselves more and more to this industry. Many see danger here for horse-breeding, as they do for rearing draught horses. Yet there is room in Algeria for all three industries: war horse, draught horse and mule. They do not exclude one another, but on the contrary, do not supplement each other, as they do not interest the same factors. As Algeria possesses native mares of various types, it is more rational to utilise them according to their aptitudes.

DONKEYS. — These are very important to the natives for means of transport. Before 1916 they were never in much demand on the market. The French War Minister bought 5000 in that year as pack-animals. But this temporary market will have little effect on their improvement. Besides they are splendidly adapted to the life of privation and work that they live under the Arabs. A few choice specimens, 1 metre 30 cm. in height, have received special care as being stud jacks.

CATTLE. — In spite of the morphological differences between the cattle of the East (Guelma) and those of the West (Oran), most writers derive Algerian cattle from a single branch. The result of undirected breeding.

(1) 1 Quintal = 2.0 lbs.

vigorous and active, quiet and hardy, they lack early maturity, weight and milking capacity. The alternating seasons of long dearth and short periods of abundance retard their development, so that they only become mature at 7 years, but do not change their faculty of assimilation, so that 3 months of good pasturage suffices to change them from almost emaciation to a good condition of fatness. The best specimens then weigh from 360 to 400 kg., while the average weight varies between 250 and 300 kg. The size of these animals is thus insufficient for draught purposes, in spite of their untiring energy.

Cows. — The native cows are very poor milkers and moreover will not stand to be milked in the absence of their calf. This has led to the introduction of French dairy animals, in order to increase the milking powers of the Arab cows (Guelma), or better, as time allows, to replace them by crosses with the imported breeds (Sétif-Souk-Ahras).

The latter procedure tends simultaneously to increase the type. It has been tried with various breeds, and experiments showed that the Durham is unsuited to Algeria; that the Charollais breed gives good working and butchers' animals (Aïn-Smara, Meskiana); that the Tarentais breed is perfectly suited to live in the Souk-Ahras regions; that the Schwytz at Sétif has remained true to type, while retaining its milking qualities; that the Norman and Montbéliard types cannot leave the breeder's stable.

But these isolated experiments as yet have had no great influence on the general condition of the cattle as a whole. It will only be entirely improved when sufficient reserve food will have been grown on each farm, whether European or native, to provide abundance of healthy food for the animals in any season. Again, crossing can not be usefully undertaken until science has found remedies against *Piroplasmosis*, a disease sometimes destroying, in a few weeks, the results of several years.

SHEEP. — Without considering the breeder's varieties, Algerian flocks can be divided into a fixed group, a group of limited migration, and a group of extensive migration. Their number, like those of cattle, depend on the effects of good and bad seasons or years. Dearth and a severe season causes a decrease of up to 50 per cent of the numbers of the extensive migration flocks, while the others rarely lose more than 10 per cent. of their numbers.

A considerable mortality has notable effects upon the Export trade in sheep. The export usually amounts to one tenth of the total number, a part to which must be added the average accession of 150 000 head from Morocco. This trade provides the greatest part of the income (about 40 million fr.) of the native herdsmen. Thus, sheep provide the most important question of Algerian livestock breeding, both from economic and social points of view. For its resolution, it must be attempted: 1) to ensure the existence of the flock during dry years and severe winters; 2) to improve the yield and quantity of meat and also, as a side line, of the wool; 3) to increase the total number.

The first point can easily be solved for the fixed group, but less so for

the limited migrants, and this solution is quite impossible for the extensive migrants, as reserve food presupposes cultivation and settling in one place.

Improvement could be realised by continual and well directed selection of the nomad and semi-nomad flocks, whose essential ability for travel and primitive mode of life must be preserved.

Crossing with suitably chosen early maturity breeds would give good results in the fixed flocks.

If the total number can be increased with the fixed groups, it can not as yet attain, in the migratory flocks, the dense population obtained in New South Wales, Australia, the Cape, and in La Plata. The regions supporting the southern flocks seem to have attained their maximum capacity, for the constitution of native property has considerably reduced the common lands, and the absence of water renders extensive pasture regions unavailable. As it is not possible to create water supply everywhere, it is evident that exportation is a regulating operation for the migratory flock as it maintains the total number at the best point suitable with regard to the food actually available.

This exportation, which began about 1848, takes place from May 15 to the end of September. It commences from Oran which, on account of its latitude, has earlier vegetation. It continues by Algiers, and then by Constantine placed further north and at a higher elevation. The gross weight of the sheep exported is, at the time of leaving, about 41.5 kg., on the average, those from Algiers being the heaviest and those from Constantine the lightest.

To satisfy trade requirements, the natives who used to keep their sheep till 4 years old, now sell them at 3 years old at the latest. Of animals over that age, only the surplus ewes in the flock are kept. The replacing of exported or butchered animals or those dead from disease is thus ensured by this permanent excess.

Sheep rearing is particularly carried out for meat production. A cold store, which will be working in 1918, will give a further impetus to the aims of meat production.

CAMELS; GOATS. — Goats and camels share, together with sheep, the difficult conditions of existence in the south and on the high plateaux. They receive no care and are only differentiated from those in the wild state by their sociability and tractability. During their life, they are not the objects of any internal trade. Goat skins provide good recipients for the natives and are also in good demand for export, reaching 12 000 quintals per annum worth 3 500 000 francs.

These animals are most valuable to the natives on account of the milk, meat and wool they produce, while the camel is indispensable for transport in the south. Because of these facts, their breeding should be encouraged. It would, in addition, profit by all the improvements in feeding brought about for the breeding of sheep, the vicissitudes of whose life they share.

PIGS. — Pig breeding is carried out solely by the Europeans, as the Koran forbids it to the natives. However, this trade tends to become important, particularly at Oran. From Oran are exported half-fat pigs which are completely fattened in the neighbourhood of Marseilles. The export

number varies between 10 and 20 thousand. It could be very greatly increased for Algeria is well suited to the three stages in pig-breeding: production of sucking pigs and their sale after weaning; pasturage on common land till 50 to 60 kg. in weight; fattening up to the average weight for export or killed for the local pork butchering trade, when 90 to 100 kg. The market is quite safe as France and Algeria are large importers of pork products.

From this rapid summary of the present state of breeding in Algeria, it may be assumed that its improvement necessitates the consideration of urgent and complex questions.

Urgent, because without considering the special needs of Algeria, it is evident that the present crisis will greatly reduce the total live-stock of Europe. Algeria, who has already aided France in such a way as can only be adequately judged after the war, should at once get ready to give the help that will then be certainly asked for.

Complex, because these questions at the same time concern economics, agriculture, zootechny, administration, etc.

To resolve these problems suitably and fruitfully, the Governor General, M. LUTAUD, who is specially concerned with the development of agriculture in Algeria, founded in 1914 under the direction of M. BRUNEL, Director of Agriculture, Commerce and Colonisation, a special Commission uniting all the principal breeders and experts. Present conditions have prevented the commission from meeting. But already a general plan has been worked out including research and experimental work, in carrying out which the various Agricultural Departments and the Livestock breeding Department (soon to be founded) will collaborate with the interested parties of proprietors or groups of proprietors.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1 - **International Yearbook of Agricultural Legislation.** — *International Institute of Agriculture, Rome 1916.*

The International Institute of Agriculture has published the fifth volume of the *Yearbook of Agricultural Legislation*, which contains the laws relating to agriculture published in the different countries of the world. The *Yearbook* is divided into: Legislation regarding statistics — Commercial legislation — Financial and Customs legislation — Laws concerning animal products — Laws regarding agricultural organisation — Laws concerning diseases and animal pests of plants — Legislation for cooperation, insurance and credit — Laws concerning Real-estate — Legislation regarding relations between capital and labour in agriculture — Legislation concerning rural hygiene and rural police.

Some brief indications of the most important laws published in the technical parts of the *Yearbook* may be given.

Chapter I of Part IV relates to laws for crops during the war and gives the whole text of the decrees of the German Empire of March 31, 1915 and September 9, 1915 with the object of providing for sowing down crops during the war. — The Austrian Empire published, on March 3, 1915, a decree to provide for the reclaiming of uncultivated land during the war, and on May 6, 1915, another decree providing for the utilisation of all the ground which is suitable for use as pasture. — France, by a decree of September 7, 1915, proposed to develop agricultural production during the war, by supporting the use of agricultural machinery by means of grants to aid purchase. — Greece, by a law dated October 28, 1915, has decided the rules to be followed for agricultural progress, in spite of the special conditions owing to present circumstances. — Italy, by a decree of June 3, 1915, has taken steps to assure the quick and steady execution of work

related to the crops, and by another decree of June 6, 1915, has authorised the Minister of Agriculture to buy agricultural motors and machinery and to give premiums to those associations which, by means of the implements they possess, undertake the methodical execution of agricultural work of general utility.

Chapter II of Part IV contains the measures taken to provide for the normal development of crops in general. It contains a law of the Argentine Republic of June 8, 1915, which obliges the Executive Committee of the Corn Exchange to buy seed for distribution to agriculturists unable to do so, and two laws of Manitoba (Canada) of March 10, 1915, with the object of providing seed for such agriculturists as are unable to obtain it directly. — In the chapter on forests, the *Yearbook* publishes the laws of the Grand-Duchy of Baden, China, New Hampshire (U. S. A.), Regency of Tunis, Greece and Uruguay, which deal with the administration of the forests, reafforestation, forests police, etc. The Chinese law of November 3, 1914, which organises forest administration throughout China and gives measures for reforestation, is of special interest.

Part V of the *Yearbook*, devoted to animal production and products, shows the legislative activities of the various countries to assist animal production and products. This activity is shown under: Measures for developing and improving Breeding. — Diseases of Animals. — Hunting and Fisheries. — Beekeeping and silkworm raising. — The English law of July 29, 1915, which has for object the maintenance of a certain number of livestock for the duration of the war, and for 12 months after the cessation of hostilities, deserves special attention. To attain this object, the law, which applies to Ireland, Scotland, Wales as well as England, authorises the Departments of Agriculture to prohibit or limit the slaughter of livestock, to prohibit or limit the sale of the meat of animals under a certain age, to give powers to local authorities to assure the administration of the law, etc. The Spanish law of December 18, 1914, and the regulation of June 4, 1915, regarding preventive measures and the control of diseases of animals are also important. The law and the regulation are divided into two categories: the first regulates the internal organisation of the Department for the control of diseases of animals and states the guiding principles to be followed for control; the second includes measures regulating the import and export of animals.

The measures taken in the various countries for regulating agricultural organisation and education are grouped together in Part VI of the *Yearbook*. The first class includes an ample set of legislative measures. It includes measures taken in order: to create state organisations for the guidance of agricultural production, or to modify existing institutions for that purpose; to found purely advisory bodies; to found public organs of local character in order to direct the activity of agriculturists according to modern technical principals from a practical point of view. A group of Brazilian decrees is also noted, of which, one of January 13, 1915, defines the functions of the Secretary of State for Agriculture, another of January 27, 1915, creates the Department of Animal Husbandry and regu-

lates its activities, while a third of April 6, 1915, regulates the functions of the Department of practical agriculture and a fourth, of Jan. 27, 1915, controls the working of the federated zootechnical Stations.

Part VII contains the regulations issued in 1915 for the control of plant diseases, weeds, and animals injurious to plantations, to control pests that have already appeared and to help agriculturists having suffered from the pests. Many of these regulations are in relation to the control and destruction of locusts; the most important laws are those of: Colombian Republic, November 15, 1915. — Costa Rica, June 3, 1915. — Philippine Islands, February 5, 1915 — Madagascar, October 5, 1915. — Guatemala June 5, 1915. Among other decrees given in this part of the *Yearbook* may be mentioned the French décret of February 5, 1916, extending the duties of the Department of Phytopathological Inspection, created by decree of May 1, 1911, modified under date of January 16, 1913, and which devotes this Department, at first limited to horticulture, to agricultural production in general. — A law of British Columbia (Canada), of March 6, 1915, contains regulations for the control of weeds, and a decree of Uruguay of January 16, 1915, regulates the carriage of plants in order to prevent the spread of plant diseases.

- 2 - **Agriculture in Guatemala** (1). — LEMUS MANUEL (Director General de Agricultura, Minería, Industria y Comercio), in *Centro America, Organo de Publicidad de la Oficina Internacional Centro-Americana*, Vol. VIII, No. 3, pp. 322-340, figures. Guatemala, July-September 1916.

The territory of Guatemala, covering 109 960 sq. km. has a very varied topographical outline; between altitudes from sea-level to 4600 m., it has: large areas sloping gradually from 800 m. to the sea on the sides towards the Pacific and Atlantic — high plateaux from 800 to 1500 m. — mountains between 1500 and 460 m. — and three varieties of climate corresponding to these three zones: torrid — temperate — relatively cold. In consequence of the variety of soil and climate, it possesses a very rich fauna and flora and is suitable for the cultivation of the most varied crops. It has rich mineral resources, but agriculture constitutes its main source of prosperity.

CEREALS. — Maize is the chief cereal cultivated in the 3 climatic zones of the country: it may be said that it is to be found on every farm, but it is chiefly grown by the Indians. The production, in normal years, (2 761 000 metric quintals), suffices for local consumption and forms the principal basal food of the country. If better methods of cultivation were adopted the production could be doubled.

Although the country has vast areas well suited for the growth of wheat and which might produce quantities in excess of that required for

(1) See also: *B.* 1910 p. 7; *B.* 1911, No. 714; *B.* 1913, No. 631.

The scientific names corresponding to the local names in the above paper have been added by the Editor with the help of the work by Dr MIGUEL COLMEIRO: *Diccionario de los diversos nombres vulgares de muchas plantas usuales o notables del antiguo y nuevo mundo*. Madrid, Gabriel Alhambra, 1871. (Ed.)

ome consumption, yet Guatemala is partly dependent on external sources for wheat and wheat flour; nevertheless the growth of wheat is spreading and will probably suffice, in a few years-time, for the needs of the country.

Rice is grown in several districts and is of excellent quality, being superior to the imported rice; again the production is insufficient for home requirements and could be much increased.

The same applies to Barley and Oats.

Three varieties of Sorghum are grown, which are mostly used as forage, but, in some localities, the seeds are mixed with those of maize at the rate of 25 to 50 % in order to make a sort of cake. Two varieties "maicillo blanco" and "maicillo rojo", are suitable for growing in dry soils, although they grow better in cool soils.

LEGUMINOUS PLANTS GROWN FOR SEED. — Beans, which with maize constitute the principal foods, are cultivated all over the country, usually in small areas. Many varieties are grown, the most common and best of which is the black variety. According to data collected by the "Jefaturas Politicas departamentales" the crop in average years is 85 000 quintals; this figure is below the reality, as it does not include the amount consumed in the farms themselves. Only small quantities of beans are imported and men of varieties not acclimatised in the country; on the other hand, small amounts are exported from time to time to neighbouring republics.

Ordinary beans are especially cultivated in the cold zone; the average yearly production is about 19 000 quintals. Peas, lentils and chick peas are grown and consumed on a limited scale.

FORAGE PLANTS. — For breeding and fattening livestock are mostly used: natural hay — maize (either green, as grain, or after removal of the grain) — "zacatón" (*Epicampes macroura*) — "parà" (*Panicum molle*) — sorghum — lucerne — trefoil: Several foreign leguminosae; particularly alfalfa, have just been introduced and are being tested.

TUBERS AND ROOTS. — The growth of the potato is not as widely spread as is desirable because of the diseases to which it is liable, thus large amounts of potatoes have to be imported.

Several excellent varieties of sweet potato (*Ipomoea Batatas*) are grown. This crop is almost entirely grown by the Indians, using primitive methods.

The "Manihot" or "Yuca" (*Manihot utilissima*) is, after the potato, the most common starchy plant.

The "Ñame" (*Colocasia antiquorum*) is somewhat grown, particularly in the department of Izabel, and is gradually spreading.

The "Yuquilla" (*Manihot carthaginensis*) does well in the temperate zone, but is cultivated on a small scale.

The "Malanga" (*Xanthosoma sagittifolium*) has been recently introduced and does well in the warm zone.

TEXTILE PLANTS. — Several are grown, especially cotton — "maguey", *galea americana* — *Fourcroya gigantea* — "escobillo" — "kapok" (*Eriodendrum anfractuosum*) — and various species of *Musa*.

The native varieties of cotton have a brown or white fibre, but short

and thus little in demand. All the exotic varieties from "Sea Island" to Egyptian, from the Peruvian tree form to the "Caravonica", are acclimatised in Guatemala, without degeneration, even with benefit, as most of them have become long-lived varieties. The cotton crop has not been grown to its full extent because of 1) the diseases attacking cotton in low lying and damp soils, where it would grow best; 2) the scarcity of manual labour at cropping time, which coincides with that of coffee; 3) the high rents of land.

Several species of *Agave* give fairly thin fibres, which are made into rope or similar articles; this industry exports a certain amount. Up to the present wild plants only have been used, but their cultivation has been commenced. "Escobillo" gives abundant fibre, easy to obtain, and grows so rapidly on low-lying ground that it becomes a weed in coffee and sugarcane plantations.

"Kapok" is very common, but not much gathered.

The growth of textile plants could be considerably developed in the Republic.

PLANTS YIELDING OILS — The wild oil-bearing plants of Guatemala are very numerous but few are regularly cultivated and then only on a small scale. Among these latter are: the coconut tree — *sejame* — *Arachis hypogaea* — "chan" (*Salvia chio*) producing the best drying oil known — "aguacate" (*Persea gratissima*) whose oil rivals that of the olive — flax — castor-oil plant. Among the wild oil bearing plants, the most important are: "corozo" (*Attalea Colume*) (1) used for the production of a cooking fat — "Jocote Marañon" whose kernels give a very delicate edible oil, while the pericarp of the fruits furnishes a strongly caustic resin — "pinón" (*Jatropha Curcas*) — "arbol del sebo" (*Myristica sebifera*) — "arrayan" (*Myristica cerifera*) — "chilicayote" (*Cucurbita ficifolia*) and another *Cucurbita* sp. called "pepitoria" are cultivated a little for their seed, used as a condiment; an edible oil can be extracted from these seeds.

PLANTS YIELDING DYES. — These are not cultivated; only a few of the wild plants are used, especially: "palo del Brasil" (*Caesalpinia brasiliensis*) — Logwood or "palo de tinte" (*Haematoxylon campechianum*) — "yema de ueno" (*Lucuma Rivicola*) — "tiñehamaca" — "jiquilite".

PLANTS YIELDING TANNINS. — There are many wild plants yielding tannin in the country, including: "quebracho" (*Aspidosperma Quebracho*) — "encino colorado" (*Quercus tinctoria*) — "mangle" (*Rhizophora Mangle*) — "Nacascalote" — "palo de Nance" — "pepita de Aguacate".

The plants most usually employed are: "encino colorado" and "nacascalote". None of these plants have been utilised under regular cultivation.

PLANTS YIELDING RUBBER. — 1500 quintals of rubber were exported from Guatemala in 1914. The greater part of the rubber crop is obtained from wild trees in the forests covering the Atlantic and Pacific Coasts;

(1) See B. December 1916, № 280.

the two coastal regions fairly extensive rubber plantations have been established, but have not as yet commenced producing.

STARCH YIELDING PLANTS. — After coffee, sugar cane is the most important crop grown in Guatemala. In many plantations two crops are grown simultaneously. On adding to the latter those plantations solely growing sugar-cane, we get 1906 plantations covering 295 *caballerías* or 13222 hectares producing 92500 quintals of refined sugar or 136 000 quintals of crude sugar; more than 46000 quintals of the latter were exported in 1914. The principal sugar manufactures of the country possess the most up-to-date machinery.

STIMULANT, AROMATIC AND MEDICINAL PLANTS. — Coffee constitutes the most important crop produced in the country and also the principal export. The following varieties or species are cultivated:

Coffea arabica (forms 85 % of total plants). *C. Maragogipe* — "Bourbon" coffee (1) — "San Ramón" coffee. *C. robusta* has recently been put under cultivation. In 1913, there were 2076 planters occupying 2000 *caballerías* or 90 000 hectares; there were 77 880 700 coffee plants producing 424 867 quintals. The preparation of the crop is carried out according to the best and latest principles; excellent coffee being produced, obtaining much higher prices than Brazilian coffee. The crop is spreading but slowly, — owing to the lack of manual labour. The rent of land for growing coffee (mostly private property) varies between 320 and 640 fr. per hectare.

The Guatemala cocoa-plant is said to be the best in the world, but its growth has decreased as the planters find coffee-growing more profitable.

The Flora is very rich in medicinal plants, which are used for popular medical treatment; the official pharmacopœia only includes a small number.

MARKET-GARDEN AND ORNAMENTAL PLANTS. — All the year round all kinds of market-garden produce come to market, including produce from both tropical and cold zones. Market-gardening is only carried out on a small scale, often only for home use. Flower growing, carried out in the garden round nearly every house, has progressed greatly of late, and economically is very profitable; yet it is only carried out on small areas.

FRUIT TREES. — All the fruit trees of the warm, temperate or cold zones grow in Guatemala. Apple, pear, cherry, plum, quince, walnut, etc., all produce good fruit at altitudes between 800 and 4000 metres. Native trees are: citrus (orange, citron, sweet lime, etc.). — *Persea gratissima* — *Carica Papaya* — pineapple — custard apple (*Anona* sp.) — "guanabana" (*Anona montana* and *A. muricata*) — "zapote" (*Sapota Achras*) — "mamey" (*Mucuna mammosa*) — "manzanillo" (*Hypomane Mancinella*) — "acerola" (*Crataegus Azarolus* — "ingerto" — "Jocote mataño" — cactus, etc. The most widely grown trees are the 3 species of banana: "banano" (*Musa sapientum*), "platano" (for cooking) *Musa paradisiaca* and "guineo". In 1915, more than 5 million bunches of these 3 species were consumed in the country, 3 217 000 being

(1) See No 36 of this Bulletin.

(E.A.)

exported in addition. The growth of the bread fruit trees (*Artocarpus* sp.) has been started along the northern coast and in the department of Izaba. Several large undertakings are solely devoted to specialised fruit-growing; the most important is the "United Fruit Company".

FORESTS. — From the forests of Petén about 4 million "caoba" plant (*Swietenia mahagoni*) were exported through Belice and Mexico; nearly 200 000 plants were exported from the ports of Livingstone and Puerto Barrio and nearly 50 000 from Puerto San José. From the department of Petén nearly 276 000 kg. of "chicle" are exported every year.

BREEDING OF LIVESTOCK. — Cattle are still imported, but in less number than formerly, and as breeding has rapidly progressed owing to milk and beef production, Guatemala will soon become an exporting country. The natural pastures are suited both to rearing and fattening stock.

Many proprietors have, with the help given by the Government, imported breeding animals belonging to the best milk or meat producing or working strains. Crossing with native breeds has given good practical results.

Good types of horses and mules exist, but few breeders devote themselves to such specialised work.

Sheep breeding has lost ground because of the competition of woollen cloth mixed with other fibres and sold more cheaply than the home article. Nevertheless some breeders have imported best type animals with a view to the development of sheep breeding.

Pigs, few in number, are mostly kept by the Indians. The production being sufficient for the needs of the population, there is no importation. Lately some well-bred animals have been imported and in consequence this industry will probably assume considerable importance.

AGRICULTURAL
EDUCATION

3 - **The First Agricultural Demonstration Trains in Russia.** — ДЕНСКИН В. (DENSKIN V.) in *Сельское хозяйство и Агрономическое* (Agriculture and Forestry), Vol. CCLX, Year LXXVI, May, June and August, pp. 10-30; 161-179; 506-521. Petrograd, 1910.

In Russia, the first agricultural demonstration train was established on the Vladikavkaz railway, which belongs to a private company. The idea of a such a movable agricultural museum and lecture room was suggested to the Railway Company in 1908 by the Don-Kouban-Tersk Agricultural Society (1). The Company, which had previously tried to encourage the development of some branch of agriculture among the numerous railway men, wrote in 1912 in a report of the general Direction that 40 per cent of the total goods carried by the railway system was formed by agricultural products, principally cereals and that it was to the interest of the railway company to cooperate in the agricultural development of the region; it indicated as a means to be used, the creation of testing grounds in the railway stations, which should act, according to the needs of the locality as active centres of agricultural propaganda. Ten of these experimental fields were to be founded, and in addition, a silo was to be built at Beslau station in the

(1) As regards these special carriages for travelling instruction, see B. 1913, N. 676. (E4)

maize region. This proposal was received favourably by the general Direction, and not long after, the Agricultural Department nominated agricultural experts to organise the work of the first three experimental fields, which were to be established the same year.

In addition, the Railway Company exchanged ideas with the local Agricultural Societies and the Agricultural Department with good results, so that on September 26, 1913, the first agricultural train, made up of 11 carriages, could commence its itinerary on the Vladikavkaz Railway; it visited 48 stations in 48 days and about 60 000 people came to see it.

On account of the satisfactory result of this first trial, another train was organised in the spring of 1914 with the chief aim of selling the seeds of forage and kitchen-garden plants, insecticides, books on agriculture, etc.

The train was also utilised during the autumn. It then comprised 14 carriages: 1 for teaching material regarding field cultivation — 1 for economic zoology — 1 for fruit trees — 1 for beekeeping — 1 for poultry-keeping — 3 as platforms for agricultural machinery and implements — 1 for the sale of books on agriculture — 1 (second class) for the agricultural staff — 1 (first class) for dining room — 1 (fourth class) for the assistants — 1 as platform for exhibiting diagrams, etc., and for lectures — 1 cold storage car. The train was in commission for 66 days (Sept. 16 — November 21.); it stopped at 58 stations, and was visited by 41 586 persons, including: 12 601 agriculturists — 18 506 women — 20 464 scholars of both sexes accompanied by their teachers.

In the spring of 1916, the train was organised for the sale of seed, insecticides etc., selling a total value of 536 000 francs. The sale of seed gave such encouraging results that the Railway Company has decided to rent the necessary ground to produce the seeds of kitchen-garden plants, while the Agricultural Department will provide the seed. In consequence of such results, the Department has awarded a grant of 16 000 francs for the purchase of teaching-material, and the Railway Company has commenced building a lecture car 20 metres long, with a cinematograph, projection lantern, and to contain 200 persons. At present, the work of the train is carried on under a director who has 3 assistants and one agent for the sale of seed, etc., and who gets in touch with the local agricultural organisations to settle the propaganda work to be carried out in each district. The Author, who is now the director of the train, concludes his report thus:

1) Agricultural trains may become a powerful means for agricultural propaganda work, and contribute to the development of all kinds of farms, particularly small farms.

2) The activity of this agricultural train ought to correspond to the real needs of local agriculture and should as far as possible be always based on the results of local agricultural experiment stations and local farms showing the most progress.

3) The work of the train should be intimately connected with that of the local agricultural societies and with that of the States.

4) Given that the state of agriculture has a great influence on the goods-traffic, and consequently on the Railway returns, the Railway Com-

pany should regularly provide the expenses for the agricultural trains as a means favouring a greater use of the railways crossing the agricultural regions of Russia.

5) Given that each railway traverses several regions and provinces, each having its own agricultural society, it is necessary, when establishing an agricultural train, to establish also an agricultural organisation capable of carrying out the work in all the regions traversed by the railway, and in cooperation with the local societies.

6) Given the national importance of the agricultural trains, it is to be desired that, if they are to be instituted on all the railways, a special law should be passed concerning them and treating them as an institution.

In 1914, following the example of the Vladikavkaz Railway, the Moscow-Kazan Railway has instituted a special agricultural train, and the South-East Railway organised in 1916 its first agricultural train for the sale of seed, etc.

4 - **The Volunteer Cooperators of the U. S. Department of Agriculture for the Advancement of Farming.** — *U. S. Dep. of Agric. Weekly News Letter*, Vol. III, No. 46, Washington D. C., June, 21 1916.

Nearly 770 000 persons, largely successful farmers, are now aiding the U. S. Department of Agriculture by furnishing information, demonstrating the local usefulness of new methods, testing out theories, experimenting and reporting on conditions in their districts. This army of volunteers receives no pay from the Government. It is estimated that at least one farm out of every twenty is working in some way with the Department of Agriculture. With such a large number of farmers willing to work with the department and the colleges of agriculture, and to test out their recommendations a significant change has taken place from the day when the average farmer was decidedly sceptical about scientific agriculture. The wide use made by the department of agriculture of this large number of practical farmers, the great majority of which are men who farm for a living, indicates clearly how erroneous was the once prevalent idea that the department consisted mainly of agricultural scientists and college-trained men, who were far more at home in their offices than on actual farms.

In a general way the cooperators may be divided into three classes: those who furnish the department with specific information acquired in the course of their regular occupation, those who demonstrate in actual practice the agricultural methods recommended by the department, and those who volunteer to perform with new crops and new methods the experiments which furnish science with the necessary data for practical recommendations. Prominent in the first class are the 158 600 crop correspondents who make possible the Government estimates of crop production and values. Trained experts in the Bureau of Crop Estimates take the reports of these men and by careful comparison and averaging arrive at a knowledge of actual conditions throughout the country which could not be obtained in any other way.

Without such a system the knowledge possessed by any one individual would necessarily be limited, to local conditions, and it is no longer

local but national and world-wide conditions that regulate business. This fact is occasionally overlooked by persons who are surprised to find that a short crop in their own section may be accompanied by low prices and are in consequence inclined to question the accuracy of the Government estimates.

A corresponding service is rendered to the Weather Bureau by its corps of observers. In addition to the reports, from sea captains there are 4560 observers who report temperature and rainfall regularly, 2770 who display or disseminate forecasts and warnings and 1300 who report weekly during the crop-growing season upon the effect of weather conditions.

In its researches and investigations the department is also in great measure dependent upon reports from cooperators, 1500 railroad station agents, for example, have been instructed by railroad officials to furnish the office of Markets and Rural Organisation with postcard reports of shipments of perishable crops which are in the market news service of the office. Tariffs and other data are also supplied by the railroads; the cotton exchanges and individual firms send quotations, samples and other information; 400 cold-storage plants report monthly on their holdings of apples; 500 millers, grain dealers, chambers of commerce, etc. furnish the Bureau of Plant Industry with data in connection with the work of grain standardization, and 1200 creameries and cheese factories report to the Bureau of Animal Industry.

These, of course, are only a few instances out of many. They serve to show, however, the ways in which the department keeps in touch with practical business conditions and is assisted by the same men whom it is working to assist.

In the second class of cooperators are the thousands of farmers who, under the supervision of county agents and specialists from the departments and the agricultural colleges, are working out on their own farms the methods recommended by scientific agriculture; the boys and girls of the pig, poultry, corn, and canning clubs who are demonstrating the neglected possibilities of profit in these fields; the women who have adopted for their own benefit and as a means of instructing their neighbours in improved house keeping; the many thousands of members of farm bureaus, county associations and community clubs; nearly 10 000 leaders in club work for community welfare, and the State officials who aid in extension work, in the distribution of animal serums and vaccine and in other ways.

This demonstration work is of the utmost importance in the spread of sound agriculture.

It is almost impossible to name the many forms in which it is being carried on, but one instance of its effect in Alabama is illuminating. A few years ago crimson clover was an unknown crop in that State. The department decided after considerable study that it was one of the most suitable leguminosae for the section and determined to introduce it. Ten farmers each in 10 counties agreed to plant 1 acre as an experiment. Two years later there were 250 000 acres in crimson clover in Alabama.

Another important demonstration in progress at the present time is concerned with cultural methods for sugar beets. In this 1000 farmers are taking part. Another thousand in the arid areas of the Great Plains are planting trees to make shelter belts as recommended by the department. In the cotton belt 80 farmers are demonstrating the advantages of superior varieties and improved cultural methods, and 50 in South Carolina and Alabama are showing how to breed wilt-resistant cotton and are producing for sale seed of varieties developed by the department.

The third way in which farmers are actively cooperating with the department is in the conduct of experiments. These are as varied as the demonstrations.

More than 11 000 are growing the plants which the department introduces from foreign countries. Sixty farmers are now furnishing the land and labour for experiments in corn improvement and 30 are aiding the tobacco work of the department in the same way.

Seed corn furnished by the department is being tested by 600 farmers who, to a certain extent, are also demonstrating the varieties they test.

There is no doubt that practical farmers and business men who devote their time to the department undertakings believe them vital to their own affairs.

CROPS AND CULTIVATION.

5 - **Weather Forecasting and Mountain Stations.** — FERGUSSON S. P., in *The University of Nevada Agricultural Experiment Station Rose, Bulletin* No. 83, pp. 4-30. Carson City, Nevada 1915.

The writer discusses the advantages to be obtained, in regard to weather forecasting, from the comparative statistics furnished by stations situated at the foot and summits of mountains. Observations have been made at Mt. Rose (3292 m.) and at Fallon, situated 97 km. to the East of Mt. Rose in the Carson Luik Valley, at an altitude of 1208 m. The most important results are appended. They are also confirmed by those from other mountain stations.

1) On Mt. Rose, during the period 1911-1914, 32 cases of abnormal and rapid fall of temperature were observed; these were accompanied at the Fallon Station by: a) in 15 cases, an absolute fall simultaneous with the above; b) in 7 cases, a slight rise of temperature; c) in 10 cases, a corresponding fall in temperature, occurring not simultaneously but in the course of the following 48 hours.

The most conclusive results were obtained at Mt. Royal (244 m), Canada, where the thermometer was used in conjunction with that of the station in the plain, viz: the observatory of the University of Montreal.

a) When the temperature at the upper station remains invariably higher than that at the lower station, the weather tends to remain stable, or to become warm;

b) on the other hand, the occurrence of lower temperatures on the mountain tops is to be regarded as an indication of the early arrival of a cold wave in the plain (cf. case c, Mt Rose).

2) When the falls in temperature at foot and summit are simultaneous a cyclone or an anticyclone may be expected over the region concerned.

3) The movements of the atmosphere in general are strongly influenced by the features of the mountain relief between the highest and most isolated peaks. The data collected on the mountain top by no means correspond with those obtained at the same average level over the plain by means of kites and observation balloons. *

4) The comparison of data obtained at the foot and summit of mountains has clearly demonstrated the value of this type of research in establishing the effect of topography on the behaviour of the weather. The local study of optical atmospheric phenomena and a knowledge of local topographical relationships as a function of the distribution of meteorological factors are of considerable value as a means of increasing the utility of daily weather bulletins and maps.

- 6 - **The Presence of α Crotonic Acid in a Soil in the United States.** — WALTERS E. H. and WISE LOUIS E., in *Journal of Agricultural Research*, Vol. VI, No. 25, pp. 1043-1045, 1 Plate, Washington D. C., September 18th 1916.

From a sample of fine sandy loam taken from a sterile spot in a field near Marshall, Texas, United States, DR E. C. SHOREY isolated in 1915, an unsaturated organic acid. In a subsequent examination of the same soil by the writers, this compound was again isolated, and its identity with α -crotonic acid established. The infertile spots above mentioned are devoid of all vegetation and their area is gradually increasing. The subsoil is a stiff clay of a red colour. The soil is deficient in lime, or other basic material, and is very poorly drained. It has also been found to have a high reducing power and a rather low oxidising power; it therefore seems to present optimum conditions for the formation and accumulation of organic acids. 94 mg. of α -crotonic acid were obtained from 50 pounds of soil. Hitherto the occurrence in nature of crotonic acid has not been firmly established, and its formation in soils is very difficult to explain. It may perhaps be formed during the destruction of cellulose from β -hydroxy-acids of the aliphatic series, or by the hydrolysis of allyl cyanide, which is found in the essential oils from certain plants, such as mustard.

- 7 - **The Influence of the Lime : Magnesia Ratio in the Soil on the Yield in Seed of Sugar beets.** — See No. 38 of this Bulletin.

- 8 - **The Washing Out of Nitrates from Arable Soil at the Rothamsted Agricultural Station (England), During the Winter 1915-1916.** — RUSSELL E. J. and APPLEBYARD A., in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 1, pp. 22-27, 2 diagrams. London, April 1916.

The winter 1915-1916 was much wetter than usual at Rothamsted, especially during December and February. This is shown by the following figures obtained there.

TABLE I — *Rainfall and Percolation during the winter 1915-1916 compared with the averages for the 62 years 1853-1914.*

Month	Rainfall in inches		Percolation in inches (1)	
	1915-16	Average 1853-1914	1915-16	Average 1853-1914
September	2.49	2.34	0.83	0.86
October	2.60	3.17	1.45	1.83
November	2.38	2.60	1.93	2.10
December	5.56	2.53	5.32	2.02
January	2.24	2.33	1.83	1.79
February	3.97	1.82	3.39	1.39
Total for 6 months . . .	19.24	14.79	14.76	9.97

(1) Percolation through 20 inch gauge.

It is well known that, in washing through the soil, water carries with it a considerable amount of soluble material and produces 2 effects: 1) the deflocculation of the clay: 2) the removal of the nitrates.

At Rothamsted, the loss of nitrates was least on heavy land and greater on good land and on light land. It attained the maximum on land that had been well manured the previous year and either fallowed, or bastard fallowed, these being the conditions under which the maximum amount of nitrate production goes on in the soil. The writers illustrate, by means of a diagram, the changes that occurred in the amount of nitrate on the Broadbalk dunged plots, one of which was fallowed, and the other cropped.

On the fallow plot, it was observed that from April to September 1915, nitrate was steadily accumulating in the top 18 in. excepting only in early May and early August, when percolation was high. By the middle of September, the top 18 in. of soil contained 170 lb. of nitrogen per acre in the form of nitrate, this being equivalent to nearly 10 cwt. of nitrate of soda. Then the accumulation ceased and the losses began. Throughout September and October they were not very great, but in November and December they were disastrous, so that by February the nitric nitrogen in the soil had been reduced to 50 lb., equivalent to only 320 lb. of nitrate of soda. The result of the winter rainfall, therefore, was a loss to this plot of 120 lb. of nitrogen, equal to 7 cwt of nitrate of soda per acre. The cropped plot was never able to accumulate nitrate to anything like the extent of the fallow plot, partly because the microorganisms made less, and partly because the crop took up much of what was there. No more than 90 lbs of nitric nitrogen per acre was ever shown in the analysis, but the fact that this amount was maintained in spite of the October and November percolation indicates that more had been produced, but was washed away. Even as it was a loss of 40 lb. of nitrogen is recorded, equivalent to more than 250 lb. of nitrate of soda.

The losses from various plots are given in Table II.

TABLE II. — *Nitrogen as nitrate; lb. per acre in top layer of soil of 18 inches.*

Experiment Plots	Autumn 1915	February 1919	Loss from Oct. to Febr.
Broadbalk, dunged, fallow	175	50	125
" dunged cropped (wheat)	90	47	43
Great Harpenden Field, cropped (wheat)	70	40	30
Broadbalk, unmanured, fallow	68	40	28
" " cropped (wheat)	51	46	5
Hoos, unmanured, fallow	34	9	25
" unmanured cropped (wheat)	32	12	20

Harpenden field represents fairly closely the ordinary case of land which is fairly but not unusually well done. It grew potatoes in 1914, when it had 12 loads of dung and chemical fertilisers, then followed wheat without manure. This did not exhaust the stock of quickly-available nitrogen, for there was still 70 lb. per acre in the autumn of 1915. During the winter, however, 30 lbs. per acre was lost.

The Hoos field wheat crops have had no manure for over 50 years. They are therefore in a low condition and the crop is always small, averaging only 16 bushels. Yet even its small stock of nitric nitrogen, which would have sufficed for 22 bush. the next season, was largely dissipated by the winter rain.

Taking the results as a whole, they show that the fields which had not been unusually well manured lost some 30 lb. of nitric nitrogen per acre, equivalent to 190 lb. of nitrate of soda, as a result of the winter rainfall, while the plots that had been heavily manured lost considerably more.

The obvious lesson is, that land which has been got into a good state in autumn should at once be sown, either with the crop it is intended to carry, or with a catch crop, such as mustard (*Sinapis alba*), which can be fed to sheep or else ploughed in.

In order to remedy in spring the condition of this washed out soil, it is necessary: 1) to reflocculate the clay; 2) to make good the loss of nitric nitrogen. The first is effected by the application of lime, or soot to the soil, while the loss of nitrogen can be remedied by a dressing of quick-acting nitrogenous manure, or of soot. That the latter substance serves both purposes has long since been recognised by the practical man.

9 - Carbon and Nitrogen Changes in Soil Treated with Lime, Ammonium Sulphate and Sodium Nitrate. — FORBES R. S. and SEYMOUR R. S., (Laboratory of Soil Chemistry of the Iowa State Experiment Station) in *Soil Science*, Vol. I, No. 1, pp. 76-94, VII plates, 2 fig. New Brunswick N. J. 1916.

The importance of organic matter in the soil is universally recognised, but the rapidity with which this decomposes and is lost is hardly appreciated. SWANSON has recently pointed out that 150 tons of vegetation were necessary to produce the organic matter in the surface of some typical Kansas soils, and that one ton was the least amount of organic

matter which must be returned to these soils, in addition to the stubble and corn stalks. Therefore, studies on the rate of decomposition of the organic matter in the soil are of interest.

This is the subject of the investigations carried on by the writers, who have made a series of experiments with soil treated with various organic and inorganic fertilisers, and have determined the loss of nitrogen as ammonia, the evolution of carbon dioxide, and the changes in the ammonia, nitrate, nitrogen and carbonate content of the soil. For the present, they confine themselves to communicating the results obtained with lime, ammonium sulphate and sodium nitrate.

The Miami silt loam used for these experiments contained 1.35 per cent. of carbon and 0.1137 per cent. of nitrogen; its lime requirement, according to the VEITCH method, is 600 pounds per acre. The carbon dioxide evolved and the ammonia liberated from the soil, whether treated or not, were determined by passing a current of air over soil in pots covered by bell jars, and then through standard acid and potassium hydroxide. A considerable amount of carbon dioxide was given off during the first two days that the soil was treated with sodium nitrate; more was eliminated when ammonium sulphate was used, and a still larger amount when the soil was treated with carbonate of lime, either alone, or mixed with nitrogenous fertilisers. Afterwards, the evolution greatly decreased, the amount, however, being always slightly largest in the pots treated with carbonate of lime. The origin of the carbon dioxide is not yet clear, for in one case the addition of carbonate of lime decreased the amount of carbon dioxide given off by the organic matter, while in another case it increased the amount. The loss of ammonia was about 0.3 pounds per acre in 12 weeks; it was about 10 times as great from soils treated with both lime and ammonium sulphate, but it is not at all probable that this rate would be kept up for a very long period after the application of the sulphate.

In a general way, limed soils lose less nitrogen than unlimed soils.

Further researches are necessary before the results obtained can be applied to field conditions.

A bibliography of 22 publications quoted in the text is appended to the article.

- 10 - **Researches on the Equilibrium between the Nitrogen and Carbon in the Soil.** — FELBER PAUL, in *Mitteilungen der landw. Lehrkanzeln der KK. Hochschule für Bodenkultur in Wien*, Vol. 3, No. 1, pp. 23-54. Vienna, 1916.

KASERER showed experimentally that for every soil there is a certain state of equilibrium between the nitrogen and carbon (proportion of humus) which is influenced by the chemical composition and reaction of the soil, the water and the conditions of temperature.

In order to prove this theory in relation to cultivated soils, the Author undertook a series of experiments with 13 soils, all of different geological formation and composition, such as: clay and sandy clay soils; sandy poor in humus; black sandy rich in humus; soils rich in lime; poor in lime. The soils mostly came from Szenics (comitat of Ventra, Hungary), where there is great variety of soil.

To obtain the samples, ditches were dug (in summer) with vertical walls, about 3 ft. deep and 3 ft. wide, then a sample of both surface and sub-soil was cut out with a spade. Each 10 lb. sample (about) was carefully crumbled, mixed, air-dried under protection from dust and then analysed.

The total nitrogen was determined by the KJELDAHL-JODBLAUR method and the organic matter by the chromic acid method.

In arable soil, 10 to 12 units of nitrogen were found for every 100 of carbon. In soils very rich in humus, 10 units were found, in soils poor in humus, on the contrary, 13 to 15 units of nitrogen per 100 of carbon. These proportions varied more in the sub-soil: between 11 and 14. The amounts of nitrogen and carbon decrease with the depth, the carbon more rapidly. The amount of alkaline earths in the soil has an influence in the sense that it promotes the accumulation of humus, without influencing the relative proportion of nitrogen. The relations between carbon and nitrogen are fairly constant for different soils, and it seems that they may allow of a method being elaborated to determine approximately the humus content of the soil from its nitrogen content.

The soils were afterwards modified by adding various substances, and submitting them to bacterial action. The proportions between nitrogen and carbon were compared before and after the modifications, in order to find if the relation is re-established after some time, when it has been modified by these additions. To try this, test pots were filled with 11 lbs. of earth and the following substances added at the rate of 7 parts per 100 of earth.

- 1) Earth + without addition.
- 2) Earth + lime.
- 3) Earth + soya meal.
- 4) Earth + soya meal + lime.
- 4) Earth + Rye straw meal.
- 6) Earth + Rye straw meal + lim.

In the earth without additions, the bacterial activity caused a loss of organic matter as well as in nitrogen. This imitation of fallow did not have a favourable effect on the economy of the soil nitrogen. The addition of soya meal also caused a loss of carbon and nitrogen. Part of the nitrogen of the soya seeds nitrifies easily. — The addition of straw caused less loss of nitrogen than the soya. — With lime added, the decomposition of the organic matter became more intense, but ammonia did not appear to be lost. As for nitrification, denitrification and nitrogen fixation, they were in no way influenced by the lime.

In a subsequent experiment, it was attempted to ascertain if on digesting the earth in water at a high temperature, it behaves differently than when in culture pots, and in what way. 60 cc. flasks were used and filled with 10 grms. of earth and 10 cc. of water, the whole being maintained at a temperature of 30° C. for 3 days in an incubator; into some of the flasks calcium carbonate was added. At the end of a month the water was absorbed, cracks appeared in the earth and traces of mould appeared.

Analysis showed that the carbon had diminished considerably (up to 20 %) in amount, while the loss of nitrogen was small. The relation between carbon and nitrogen was thus displaced to the benefit of the nitrogen. It was concluded that the earth behaves differently in an incubator than in the open air, as the higher temperature induces greater bacterial activity. No conclusions can be drawn as to the effect of the lime on the decomposition of the organic matter. A second experiment yielded similar results.

To ascertain how the elimination of carbon and nitrogen from a combination rich in those elements is carried out, Erlenmeyer flasks containing 10 grms of each soil together with 50 cc. of a soil-infusion and 0.5 grms of soya meal (containing 7.35 % N. and 40.4 % C) were placed in an incubator; lime was added to two samples of earth.

After 40 to 45 days, there was a considerable elimination of carbon and nitrogen; but the relation between the two was much the same at the end of the experiment as at the beginning. All the same, the relation differed from that of untreated earth, which latter had changed during the experiment in favour of the nitrogen. In one case the lime prevented the elimination; in the other case it had no appreciable influence.

To ascertain if, at the optimum temperature of *Azotobacter*, nitrogen fixation can be produced by adding energy in the form of straw meal, a series of soil samples were mixed with this meal and afterwards placed in an incubator. After 14 days, nitrogen was found to be fixed in a clay-sandy soil and in a sandy soil at the rate of 6 and 4 mg. respectively per 100 grms of soil. For each unit of nitrogen fixed, 73 units of carbon were consumed in sandy soil and 37 units in clay-sandy soil, numbers corresponding respectively to 174 and 86 units of straw. In another clay-sandy soil, the amount of nitrogen fixed even reached 46 mg. per 100 grms of soil. It did not result from the reduction of nitrates.

In order to find how saltpetre behaves in the presence of organic matter in the soil, 10 grm samples of soil were taken and to them were added saltpetre alone, and also saltpetre and straw meal. The nitrogen estimation was made by the DEWADRA method. It was found that in the sample to which straw meal had been added, the saltpetre had completely disappeared. In the tests without straw, there had been elimination of carbon, but the saltpetre had remained intact.

In another experiment, the straw was replaced by an easily assimilable carbon compound i. e. dextrose. The saltpetre also disappeared in this case although the bacteria had a sufficient source of energy available.

The results of the experiments with saltpetre seem at first sight to contradict the theory of equilibrium between carbon and nitrogen. In fact in the experiments without additions, the saltpetre remained intact, while it was partly denitrified by the addition of straw and dextrose. But as denitrification requires a source of energy that was wanting in the soils without additions, the saltpetre in these tests remained intact, while in the case of added straw and dextrose, there were no available carbon com-

unds remaining to permit bacterial nitrogen fixation after the destruction of the saltpetre. These experiments also confirm the observations made by KASERER.

The Influence on Bacterial Activity of Some Common Humus-Forming Materials of Narrow and of Wide Nitrogen-Carbon Ratio. — BROWN P. E. and ALLISON P. E. (Soil Chemistry and Bacteriology Laboratory, Iowa State College), in *Soil Science*, Vol. I, No. 1, pp. 49-75. New Brunswick, N. Y., 1916.

The determination of the nitrogen-carbon ratio in soils is now coming to be considered of much importance in fertility studies. Not only does it show the organic matter content of soils more accurately than the more or less arbitrary humus determinations, but it also throws some light upon the rate at which decomposition processes are occurring in the soil. In the case of humid soils, experience has shown that if the ratio narrows beyond a limit of about 1 : 10, the crop yield is decreased, if on the other hand the ratio is 1 : 12, or above, bacterial activities increase, larger amounts of available plant food are produced and a better crop is obtained. The question arises whether, when a soil shows a nitrogen-carbon ratio below 1 : 10 it is therefore deficient in fresh organic matter, it can be improved by the addition of materials of the widest possible nitrogen-carbon ratio.

From pot experiments with sandy loam treated with lime, it was found that ammonification, nitrification, and azotification were considerably increased by the addition of dry horse manure, cow manure, oat straw, timothy hay, cowpea hay, clover hay and corn stover, in the maximum quantities used in farming.

The greatest effects on ammonification (determined by the casein-fresh-soil method and the dried blood-fresh soil method) were obtained with the manures in most cases, although timothy hay had more effect in several instances. The oat straw and corn stover had less effect than the manures, and the legume hays, clover and cowpeas showed the least effect on ammonification of any of the materials used. Increases in ammonification due to the application of humus-forming materials were independent of the nitrogen-carbon ratio of the materials added, and were probably dependent on the chemical composition of the substances. If the materials had been used fresh, their influence on the ammonification of the manure would certainly have been accentuated. On the other hand, the leguminous green manures exerted somewhat greater effect upon nitrification (determined by the ammonia-sulphate-fresh-soil method) than the manures and had also more influence than the non-legumes, but the differences were not great enough to permit of definite conclusions. In any case, the nitrogen-carbon ratio had apparently no effect on nitrification.

Azotification, or non-symbiotic nitrogen fixation, (determined by the uric acid or dextrose fresh-soil method) was favoured by manure to a large extent; the straws had almost as much effect as the manures, while the leguminous hays had the least effect of any of the materials used. The nitrogen-carbon ratios of the materials employed were of little or no significance in indicating their effects on azotification. There were indications, however, that non-legumes and straws might increase azotification to a

large enough extent to justify their use instead of legumes which add nitrogen to the soil, but are more expensive.

The experiments with oats, which were also grown in pots, showed that the substances with the narrower nitrogen-carbon ratios, such as the legumes, increased the crop yields, while the materials of wide ratios, like the straws, decreased them. However in the case of a second crop, the non-legumes had as great an effect as the legumes, and hence previous conclusions are confirmed that with the use of the former materials, sufficient time must be allowed to elapse for azotification to occur, if as beneficial effects are to be secured as with legumes.

The article concludes with a list of 4 publications quoted in the text.

- 12 - **The Quantitative and Qualitative Activity of Nitrogen-fixing Bacteria in Water and Flooded Soil.** — FISCHER HERMANN, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 46, No. 11-16, pp. 304-320. Jena, September 2, 1916.

Parallel to experiments on manuring fish ponds carried out for 4 years at the Experimental Station for fish culture at Wielenbach (Bavaria), observations were made on the activity of nitrogen-fixing bacteria in the water and soil of the same ponds. At the same time symbiotic relations between nitrogen-fixing bacteria and aquatic plants growing in the ponds were studied.

Up to the present the following results have been arrived at :

- 1) In comparison to other nitrogen-fixing organisms, *Azotobacter* is much less numerous and active in water and soil covered with water. No definite conclusions could be made with regard to its symbiosis with aquatic plants ; on this point the experiments have to be repeated.
- 2) Distinctions must be drawn in nitrogen fixing bacteria between saphrophytes, parasites and symbiotic organisms.
- 3) As regards the qualitative and quantitative activity in fixing atmospheric nitrogen, the parasitism or symbiosis between green aquatic plants (particularly algae) and rod-shaped nitrogen-fixing organisms belonging to the group of bacteria causing pneumonia, become in the water, of great importance.
- 4) Heavy applications of saltpetre, surpassing those of the manurings, but which can appear in the drainage water, did not succeed in preventing nitrogen-fixation by the symbiotic bacteria.
- 5) As regards the produce of the ponds, the experiments showed that a non-nitrogenous manure can, provided nitrogen-fixing bacteria are present, largely increase the growth of the fish in relation to that obtained when the manure was wanting.
- 6) The activity of the nitrogen-fixing bacteria is also shown by the enrichment in nitrogen of the soil of the ponds, giving (according to analyses) about 10 times the amount accepted as being produced per acre per year by nitrogen-fixers living free in the soil of the fields.
- 7) The importance for the improvement of ponds of free-living nitrogen-fixing bacteria, principally the aerobes and radio-bacteria, can be compared, from the standpoint of qualitative and quantitative activity, with that of the nitrogen-fixing nodule bacteria ; under field condi-

lons this bacterial activity is shown rather by crop yields and, in the pond, rather by the enrichment of the soil in nitrogen.

8) The methods used to determine the nitrogen fixing power of field soil can also be employed for pond soil provided they are complemented by the determination of the fixing power in water possessed by nitrogen-fixing bacteria living in symbiosis with green aquatic plants.

9 - **The International Movement of Fertilisers and Chemical Products Useful to Agriculture (Half-yearly Review)** (1). — *Bulletin of Agricultural and Commercial Statistics* Year 7, No. 9, pp. 615-688. International Institute of Agriculture, Bureau of Statistics, Rome, September 1916.

This review contains a considerable number figures of official origin or from trustworthy private sources. It deals with the principal fertilisers (Phosphatic, potassic, nitrogenous) and chemical products employed in agriculture.

All weights are given in metric tons of 1000 kg = 2204.6 lbs.

The most important information is summarised below.

I. — *World's Production*. — Because of present conditions, it is impossible to obtain figures for the production of *natural phosphates* in 1916. The only figures given are those relating to the shipments. Speaking broadly, the latter have not decreased so much as for lack of labour as for the increase of the cost of carriage. The following table summarises the principal figures given in this review.

Production of Natural Phosphates (in metric tons).

	1916 (1st half year)	1915	1914	1913
United States	326	1 865	2 778	3 161
Algeria	163	165	226	461
Egypt	13	83	9 72	104
Tunis	224	1 359	1 444	2 285

As regards *calcium superphosphate*, the decrease of in supplies of natural phosphates and the ever increasing demand for sulphuric acid for war purposes in the belligerent countries, has seemingly decreased the supplies of superphosphates, though no figures are available for many regions. For 1916 in France there is expected to be a production of 350 000 tons against 600 000 in 1915, 1600 000 in 1914 and 1920 000 in 1913. Thus there is a reduction of more than 70 % in the figure for 1915 as compared with the normal as 1913.

In Portugal 120 000 tons are forecasted for the current year, and in Australia 30 000. In the latter country the figure has diminished from 38 000 tons in a normal year.

The production of *potash salts* is known for 1914 which is summarised and compared with 1913 and 1912. All the products show a considerable diminution.

(1) See B. January 1916, No. 13.

Potash salts	1914	1913	1912
		metric tons	
Total of crude salts	8 171	11 608	11 070
including Carnallite, Kieserite	3 651	5 302	5 282
including Hartsalz, Kainit and Sylvinit	4 521	6 305	5 788
Total amount used by agriculture	2 580	3 567	3 312
including Hartsalz, Kainit and Sylvinit	2 541	3 508	3 250
Production of concentrated salts			
manures at 20,30, 40 %	855	906	743
80 % potassium chloride	363	484	471
90 % " sulphate	70	111	116

The output and trade in *nitrate of soda* showed a large decrease in the last half of 1914 and the first half of 1915, while the second half of 1915 showed a largely increased consumption of nitrate for industrial purposes.

This state has continued during the last six months, and the augmentation has brought the figures into closer relation with the normal than was the case earlier in the war. Production for the first six months of 1916 is nearly threefold (1 488 792 metric tons) as compared with the same period in 1915 (587 876 metric tons).

Shipments have also been much larger. France in six months of 1916 has taken 120 506 metric tons while in all 1915 the purchases were only 83 202 tons. The same thing has occurred in the United States, shipment to that country having attained in the first half of 1916 more than three fourths of the total of 1915. For arrivals in Europe and Egypt, the six months of 1916 show a total of 776 169 metric tons, as compared with 410 300 tons up to June 1915, and 891 126 tons in the whole of last year. Stock at Chilean ports were 919 102 metric tons on 30th June 1916, nearly 100 000 tons more than those of the same date in 1915.

The output and commerce in Chilean nitrate of soda during the first half year of 1916 and the 3 years 1915, 1914 and 1913 are summarised in a table.

Nitrate of soda	1916 1st half year	1915	1914	1913
	in 1000's of metric tons			
Production	1 489	1 764	2 494	2 774
Export	1 356	2 031	1 848	2 740
Consignments for consumption	(a) 739	(a) 861	(a) 2 219	2 557
Visible Stocks	to June 30	to December 31		
	(b) 919	(a) 991	(a) 1 190	1 772

(a) Partial Figures only available. — (b) Chilean coast only.

With regard to *sulphate of ammonia*, the amount left for agriculture after the beginning of the European war has been steadily diminishing on account of the needs of industries. The table gives the information published in the review.

Sulphate of Ammonia	1916 (forecast)	1915	1914	1913
	in 1000's of metric tons			
Germany (sales)	—	—	406	435
Spain	16	15	15	15
France	25	42	—	74
Great Britain	33	16	17	14
Russia	production	423	426	433
Sweden		1	2	1
United States		200	166	177
Australia		7	6	5

As regards the synthetic nitrogenous fertilisers such as calcium cyanamide and calcium nitrate, the manufacturers have greatly increased their productive capacity either by enlarging existing works or building new ones. But the amounts of these manures available for agriculture has not increased proportionately. The manures are more and more restricted and in certain countries the whole output is reserved for the industrial needs of the state.

The inactivity in the European trade in *sulphur* has continued increasingly for the last six months on account of the difficulty of obtaining freight space and in the great rise in the price of coal. In the United States the production of sulphur greatly increased during 1915.

Copper sulphate has been produced in greater quantity in France, in slightly less quantity in Great Britain and Ireland, while the output remained stationary in Italy as shown in the following table.

Copper sulphate	1916 (Forecast)	1915	1914	1913
	in 1000's of metric tons			
France	25	10	21	20
Great Britain	60	60	69	77
Italy	48	50	31	44
United States	—	19	14	25

II. — *International Trade.* — International trade is practically at a standstill for nearly all the fertilisers and chemical products in Europe and here is hardly any trade in many products for certain countries like Holland, Sweden and Russia. On the other hand the trade in nitrate of soda between Europe and the United States has considerably increased.

III. — *Wholesale prices.* During the second six months of 1915 all the chemical manures and products had continually increased in price, sometimes very considerably. The increase is maintained but at a slightly lower level. It is probably only phosphates that have not varied in price. Copper sulphate has gone down in price in the United States.

The figures for the principal products are as follows :

	Average for Jan. 1916	Average for June 1916	Average for 1st 6 months 1916	Average for August 1916
in gold francs per metric quintal of 100 kg.				
<i>Nitrate of Soda</i>				
Valencia (Spain) . . .	45.29	49.83	46.95	49.21
French Atlantic ports.	37.54	40.02	38.18	40.79
Genoa	43.94	41.05	40.76	41.28
Liverpool	39.96	45.60	43.76	46.03
New-York	39.73	36.18	30.20	—
<i>Sulphate of Ammonia</i>				
Valencia (Spain) . . .	50.72	58.48	54.19	55.37
Paris	48.49	50.15	49.44	51.77
Genoa	51.40	50.40	51.46	50.49
Hull	43.71	41.99	42.18	44.38
New-York	46.27	41.73	44.11	—
<i>Copper sulphate</i>				
Valencia (Spain) . . .	166.13	205.81	198.73	203.29
French Atlantic ports.	108.20	141.05	117.51	137.82
London	14.26	130.84	124.14	124.22
Genoa	147.50	150.50	146.40	139.50
New-York	227.49	151.72	210.92	—

The *Review* concludes with a bibliography of 566 titles taken from the world literature published during the first six months of 1916.

14 - *The Utilisation of Sewage-water in Italy.* — ARZA A., in *L'Italia agricola*, Year 5, No. 11, pp. 497-502. Piacenza, November 15, 1915.

With the exception of Milan, which has for a long time used its sewage-water for irrigation, nearly all the towns in Italy turn their sewage-water into the watercourses or into the sea. Yet, a certain amount is collected both in large and small towns by companies and taken to large special reservoirs. This night-soil is richer in fertilising material than the sewage water turned into streams, as it is much less dilute. Table I shows the composition of several of them. Table II shows the relation between the 3 forms of nitrogen: organic, volatile ammonia and fixed ammonia in the night soil; it gives the results of analyses of samples taken from the reservoir at Cremona. After settling in the reservoirs, the liquid night-soil separates into a liquid upper layer containing all the ammoniacal nitrogen, and a lower layer forming a solid deposit of mud with 80 to 90 per cent. of water.

From the upper layer, assuming an average of 3‰ of ammoniacal nitrogen, 15 kg. of ammonium sulphate per cubic metre worth 4.50 fr. (at a normal price of 30 fr. per 100 kg.) would be obtained. The distillation of the ammonia presents no technical difficulty, but, in Italy, it is hindered by the high cost of fuel. The author estimates that 20 kg of coal are necessary to distil 1 cubic metre of the upper liquid and gives the cost according to normal prices.

Total N.			Total P ₂ O ₅			Potash			Towns.	Analysts
Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.		
2.24	8.54	4.20	0.10	2.87	0.76	1.67	2.09	1.88	Pisa	TARUGI and BERTINI (18 analyses).
1.98	3.90	3.30	0.38	0.51	0.43	0.82	1.02	0.94	Pisa	MASCONI (3 analyses).
—	—	3.00	—	—	0.35	—	—	0.25	Milan	MINOZZI and GRONER.
—	—	2.78	—	—	0.20	—	—	0.28	Florence	PASSERINI.
2.32	4.47	3.13	—	—	—	—	—	—	Florence	PASSERINI (7 analyses).
—	—	4.28	—	—	1.79	—	—	4.26	Scandicci Alto	PASSERINI.
1.88	3.68	2.82	—	—	—	—	—	—	" "	PASSERINI (6 analyses).
3.27	4.51	3.91	0.29	0.37	0.43	0.20	1.49	1.05	Cremona	ATA (5 analyses).

	Total N.	Organic Nitrogen	Ammoniacal nitrogen		
			total	volatile	fixed
Decanted liquid	4.518	0.168	4.350	—	—
" " " " " " " " " "	3.680	0.230	3.450	—	—
Indecanted liquid	3.988	0.728	3.260	1.245	2.017
" " " " " " " " " "	4.144	0.614	3.530	1.330	2.200

Fuel	20 kg at 0.05 fr per kg.	1.00 fr
Sulphuric acid	12 kg at 0.045 " " "	0.55
Lime	5 kg at 0.03 " " "	0.15
Labour		0.50
	Total cost	2.20 fr

There is thus sufficient margin for paying ample expenses and depreciation. According to the author, it would be worth while undertaking the manufacture of ammonium sulphate in Italy with the supernatant liquid from the settled night soil, especially in the smaller towns using small apparatus capable of dealing with 10 to 15 cubic metres a day.

Recently the possibility has been suggested of extracting the ammonia by the prolonged effect of a current of air passing through the liquid but some large scale experiments by the writer have shown that the method is not practicable, as the ammonia obtained is not more than 2 per cent. of the total quantity present.

Finally the Author briefly describes the treatment of the solid residue as carried out in England and Germany in order to extract the fatty matter forming from 3 to 26 per cent. of the dry sludge (16.7 % as an average according to Dr. BECHHOLD).

- 15 - A Potassic Manure obtained from Orthoclase Felspar, in Canada. — SHAW F. T., in *Experimental Farms, Report of the Division of Chemistry, Year ending March 31, 1915*, pp. 128-129. Ottawa, 1916.

Analysis of a product obtained by heating orthoclase felspar in a furnace with limestone and iron ore, the whole reduced to fine powder. Solubility determinations have the following results:

Solvent	Soluble potash as % of the product	
Water	traces	— 0.48
1 % citric acid. O	3.16	— 3.34 — 3.15
Hydrochloric acid, density 1.115	4.49	— 4.43
Concentrated Hydrochloric acid	5.41	

With these results, it was concluded that 5.41 % of the potash could in time, become soluble, while 16.34 % will be more or less immediately soluble.

Potash Felspar or Orthoclase exists in considerable deposits in many regions of Canada. It contains from 10 to 12 % of potash, and if this potash was rendered available from the agricultural point of view and at a reasonable price, a useful industry could be established, considering the actual price of potash salts.

- 16 - The Use of Seaweed for the Production of Potassic Manures. — See No. 91 of this Bulletin.

- 17 - New Experiments on the Action of Sulphur on Crop Production (1). — PREIFFER in *Führungs landwirtschaftliche Zeitung*, 65th Year, No. 7-8, pp. 193-207. Stuttgart, 1917.

It is recognised that sulphur, on being added to organic nitrogen compounds, causes abundant decomposition with formation of ammonia, and an increase of yield results. This action of sulphur is particularly marked when associated with farmyard manure or dried blood.

To determine the effect of sulphur, experiments were undertaken on a field rich in organic nitrogen compounds, but not having been manured for a long time and having grown beets for 3 successive years without receiving any manure at all. From the standpoint of physical constitution the field showed great differences, which were clearly shown by the results of preceding crops, as well as by the sulphur experiments. The

(1) Conclusion of experiments of the same author (action of sulphur on beets) described in *B. 1915, No 798*. (Ed.)

field was divided into 24 plots, each of about 11 sq. yds. area, and receiving the following manures.

- 6 plots : Farmyard manure only.
 6 plots : " " + sulphur.
 6 plots : Dried blood only.
 6 plots : " " + sulphur.

The farm yard manure was applied at the rate of about 8 tons per acre and the sulphur at 357 lbs per acre.

Both farmyard manure and dried blood were intimately mixed with the sulphur. Each plot received an additional manuring of 1 lb basic slag and 1 lb of kainit.

Fan barley was sown on the plots. At the beginning of earing the plants on the plots having had dried blood and sulphur seemed the best developed.

The appended Table gives the average results for each series of 6 plots.

Manure	Grain		Straw		Grain and straw	
	Dry Matter	Nitrogen	Dry Matter	Nitrogen	Dry Matter	Nitrogen
	grams	grams	grams	grams	grams	grams
Farm yard manure only . . .	3 278 ± 111	73.3 ± 1.5	3 390 ± 63	23.5 ± 1.7	6 668 ± 144	96.8 ± 2.3
F Y M + sulphur	2 967 ± 177	63.8 ± 3.1	3 087 ± 172	18.8 ± 0.4	6 054 ± 347	82.6 ± 3.4
Dried blood only 2 997 ± 149	68.4 ± 3.4	3 032 ± 104	20.1 ± 0.4	6 028 ± 247	88.5 ± 3.8	
Dried Blood + sulphur	3 191 ± 115	71.5 ± 2.9	3 330 ± 106	23.1 ± 0.9	6 521 ± 212	94.6 ± 3.5

The fact that the yields of grain are very high as compared with straw is referable to the drought during growth.

The total yield, however, is high for it reaches 40.01 cwt of grain and 39 cwt of straw per acre.

Sulphur + farmyard manure caused a decreased yield in grain and straw as well as a decreased nitrogen content of the crop. All the differences are within the limits of probable variations and should therefore be checked by controls. Sulphur + dried blood acted satisfactorily, but the excess of yield is not very great.

The Author concludes that application of sulphur, either with farmyard manure, or dried blood, has produced no particular increase in the crop.

To ascertain if the experimental results agree satisfactorily with the law of probable error of GAUSS, they were compared with the yields of the

same plots under beet in 1914. In spite of variations caused by physical differences in the soil of the experimental field, the results on the whole agree very well.

The two conditions of the law of GAUSS were almost entirely fulfilled. The results of the experiment with sulphur are less suitable for an examination of this kind, but there was, however, a satisfactory agreement.

The Author is of opinion that the calculation of the probable variations is an excellent method for forming an objective opinion on the results of experiments.

18 - *Seeds and Plants Introduced into the United States by the Bureau of Plant Industry of the Department of Agriculture during the Second Half of 1913* (1). — I. U. S. Department of Agriculture, Bureau of Plant Industry, *Inventory of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction During the Period from July 1 to September 30, 1913*, No. 36, 74 pages + 6 Plates Washington, December 23, 1913. — II. *Idem*. *Inventory No. 37* (Period from October 1 to December 31, 1913) 95 pp. 6 Plates, Washington, March 25, 1916.

I. — The first list, Nos. 35 667 to 36 258, includes the seeds and plants introduced into the United States from July 1 to September 30, 1913, of which the most important are as follows:

CEREALS.

Avena sativa. — No. 36 196: Local variety originally sent from the Experiment Station at Tulun, Irkutsk, Siberia.

Hordeum vulgare. — No. 36 005: Barley from the southern extremity of Lake Titicaca (Bolivia) at an altitude of from 12 500 ft. to 13 000 ft.

Holcus Sorghum. — Nos. 36 075 to 36 077: three varieties of sorghum from San Tun Ying Chihli Province, China. Grain half white and half red, large, white and glutinous respectively—used for human consumption.

Socle cereale. — No. 36 055: variety of rye from Omsk, Siberia.

Triticum spp. — Nos. 36 142 and 36 143: Wheats from Panguipulli and Llifén, Chile, respectively. Chilean wheat brings a higher price in the European market than that of Argentina. Several varieties may often be found in the same field, some of which may prove of interest.

Triticum aestivum (= *T. vulgare*). — Nos. 35 950 and 35 981, from Quilan, Chiloe Island, Chile. No. 35 952, from Osorno, Chile. No. 36 144, from Llifén, Chile. No. 36 004, wheat from the southern extremity of Lake Titicaca (Bolivia) at from 12 500 ft. to 13 000 ft.

Triticum durum. — No. 36 003 "Chernouska" spring wheat from Semipalatinsk, Siberia.

Zea mays. — No. 35 998, variety of maize from Castro, Chile, the only one which can ripen in this cold, wet region. May be capable of being acclimatised in Northern countries.

Nos. 36 185 to 36 191; 36 195; 36 197; 36 295 to 36 253; varieties of maize with grain of different colours, and intermediate shades: white—grey—yellow—pink—red—brown, etc. with, or without spots or stripes—from Arequipa and Cuzco, Peru.

Nos. 36 192 to 36 194; 36 198 to 36 205: varieties of maize having respectively grain of the following colours: white—grey—yellow—light strawberry—black—from Oruro and La Paz, Bolivia.

(1) See also B. April 1916, No. 388.

LEGUMINOSAE.

- Phaseolus angularis*. — Nos. 36 080; 36 084; 36 085; varieties of this bean from San Tun Ying and Tientsin, China. Beans much appreciated for human consumption, young sprouts form excellent winter vegetable.
- Phaseolus vulgaris*. — Nos. 35 984 and 35 985; 35 993; 36 178 to 36 182, varieties of this bean from Chile.
- Soja max*. — No. 36 079: An early variety from San Tun Ying, China.
No. 36 116; a rare variety with beans of an olive colour.
- Vigna sinensis*. — No. 36 078: a variety of which the seeds are half white and half reddish, used as a human food; from San Tun Ying, China. No. 36 083: variety with small white seeds with a dark-coloured eye. Used for human food; comes from Tientsin, China.

LEGUMINOSAE FOR GREEN MANURE AND FOR BINDING SOIL.

- Lupinus arboreus*. — No. 35 969: a lupin from near Talcahuano, Chile. On light, rather dry soil, it grows about 4 ft. high and may prove useful as a sand binder.
- Medicago hirta*. — No. 36 060, from Kiyimbila, German East Africa, where it grows up to an altitude of 1 600 m. It can be propagated by rooted cuttings. Does well even on poor soils. Rapidly fertilises soil. Can also be used as a cattle feed. It is suggested that experiments should be made with it as a cover crop in the orchards in Florida.

FORAGE PLANTS.

- Chloris paraguensis*. — No. 36 255: from Sydney, Australia ("Australian Rhodes Grass"). Average height 4 ft. Stooling abundant. Yields twice the amount of hay yielded by *Chloris Gayana* and is a much softer feed.
- Sorghum* (= *Sorghum vulgare*). — No. 36 074: a very strong, tall sorghum with brown-red seeds, mostly used as cattle food and in spirit manufacture.
- Lathyrus* spp. — Nos. 35 961 to 35 965; 36 105: Vetches from Argentina and Chile. The variety No. 36 105 grows in sandy soil.
- Medicago arabica*. — No. 36 136; Lucerne from Kingsboro, North Carolina.
- Melinis minutiflora*. — No. 36 051; a variety from Angola, Africa.
- Paspalum Bertoni*. — No. 36 165: from Puerto Bertoni, Paraguay, a densely caespitose, perennial grass growing among rocks and sand on the banks of the Parana river.
- Pennisetum purpureum*. — No. 36 103: a tall grass with long spikes ("Elephant Grass") from Salisbury, Southern Rhodesia; grows wild in Guinea and Kamerun, West Africa and from Zanzibar to Mozambique on the East Coast.

STARCH-BEARING PLANTS.

- Ipomoea Batatas*. — Nos. 35 878 and 35 879: sweet potatoes from Lima, Peru.
No. 36 056: Very vigorous sweet potato from Mount Silinda, South Rhodesia. The tubers are of a good shape and flavour; when boiled, they are red under the skin, but of a rich golden yellow below the surface.
- Solanum* spp. — No. 35 686 and 35 687: wild potatoes collected at Guaqui Mole, Bolivia.
Nos. 35 899 and 36 093: potatoes from Guaqui and La Paz, Bolivia. The frozen tubers are sold under the name of "papa amarga" (bitter potatoes). No. 36 104: wild potatoes from the island of Concejos, Chili. There are 2 kinds, or perhaps more, of which one grows to a height of over 2 m.
- Solanum columbianum*. — Nos. 36 129 and 36 130: Potatoes with violet flowers, from San José, Costa Rica.

36 AGRICULTURAL, BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS

Solanum muricatum. — No. 36 048: "Sweet Pepino" from San Salvador, Salvador.

Solanum tuberosum. — 164 Nos. from Peru and Bolivia.

Ullucus tuberosus. — 12 Nos. coming from different places in Peru and Bolivia.

AROMATIC AND MEDICINAL PLANTS.

Panax quinquefolium. — No. 36 175. Ginseng from Songdo, Chosen, Korea, which is the most famous centre in the world for its cultivation and preparation. In this place, about 8 000 kg. of red ginseng and nearly 30 000 kg of white was produced in 1913.

KITCHEN GARDEN PLANTS.

Apium sp. — No. 35 920: a wild celery from Quilan, Chile, where it grows near the sea. It has more or less the same taste as *Apium graveolens*, and can be utilised in the same way.

Asparagus sp. — Nos. 35 976 and 35 977: *Asparagus* from Smyrna, Syria.

Brassica pekinensis. — No. 36 054: "Pai-ts'ai" cabbage from Tientsin, China. Nos. 36 111 and 36 114 are large quick-maturing varieties which have a rich flavour and are more easily digested than ordinary cabbages; they emit no offensive odours when being boiled. If covered with soil, after being stored layer on layer in a cellar, No. 36 113 will keep all the winter. No. 36 114 is an autumn cabbage. Both would be valuable additions to the kitchen garden.

Chenopodium Quinoa. — No. 35 978, from La Paz, Bolivia. Nos. 36 006 and 36 007 come from the southern extremity of Lake Titicaca (Bolivia) at an altitude of from 12 500 ft. to 13 000 ft.

Cucumis Melo. — Nos. 35 933 to 35 942: 35 963: Varieties of melon from Chili. Their shape and dimensions vary, their flesh is white or yellow, and of excellent quality.

Colocasia spp. No. 36 010: *Colocasias* from Queensland, Australia. No. 36 057: from Southern Rhodesia. No. 36 121: from Peking, China.

Cucurbita spp. — Nos. 35 943 and 35 944: squashes from Chile.

Daucus Carota. — No. 36 156: Carrot grown by the Indians. Comes from Chili.

Fragaria chilensis. — No. 35 953: strawberry with round fruit, grows wild on the sand the sea shore of Chiloe, Chile.

Raphanus sativus. — No. 35 690: good variety of radish, from Tampa, Florida; original seed obtained from Egypt. No. 36 115: a variety of radish from Peking, China; winter radish with long, green root, recommended for its stomachic properties.

Vicia faba. — No. 36 008: broad bean from southern extremity of Lake Titicaca (Bolivia) altitude of from 12 500 ft. to 13 000 ft.

ORNAMENTAL PLANTS.

Pinus Bungeana. — No. 35 916: a pine (native of China) from Seoul, Chosen, Korea. The adult trees with their smooth, shining, white bark are very ornamental.

Prunus triloba. — 36 112: a plum from Peking, China. Fine ornamental shrub, flowers early, grows out of doors. Blossoms vary from pale pink to a dark violet-rose. Much cultivated in gardens in China.

FRUIT TREES AND SHRUBS.

Anacardosa luzoniensis. — No. 35 893: from Cavite, Philippines. A newly discovered fruit ("galo"). The pulp which is very succulent and surrounds the seed is eaten, and the starchy kernel may be eaten raw, or roasted.

Artocarpus odoratissima. — No. 36 236: Bread fruit tree from Lanna, Philippines, with juicier, sweeter and more aromatic fruits than any other bread fruit tree.

- Castanea mollissima*. — No. 35 891: Chestnut from San Tun Ying, China, cultivated in China for its excellent fruit. Resistant to *Endothia parasitica*.
- Citrus* spp. — Nos. 35 690 and 35 700. Collection of citrus fruits from India, promising well: *Citrus limonia* with round seedless fruits, comes from Cawnpore — the lime "Kaghl" (*C. aurantiifolia*) with fruits with thin rind, very resistant to drought and extreme heat — the Mandarin, "Nagpur tangerine" (*C. nobilis deliciosa*), one of the oranges most liked in India.
- Juglans regia sinensis*. — No. 36 082: a walnut from Changli, Chili Province, North China. Its fruits is excellent. A decidedly hardier variety than the forms occurring in Europe, and northwest Asia.
- Mangifera indica*. — Nos. 36 029 to 36 039: Good varieties of India mangoes; 2 come from the district of Mozafferpur where the rainfall is heavy, and may thus prove useful in the very wet parts of Porto Rico. No. 36 052: "Pahutan mango" of Manila. On account of its great vigour, this variety will succeed best as a stock. No. 36 070: "Diamond Mango" from the island of Chiloane, Mozambique.
- Cypa fruticans*. — No. 36 058: from Manila, Philippine Islands: furnishes fuel, shingles for house-building, fibre for hats, mats, baskets etc., fruit for food or preserves. The sap is used, fresh, or fermented, as a drink, and for the manufacture of sugar, alcohol and vinegar. This species, one of the few that grow in brackish tropical tidal marshes, is of great use in turning the latter to account.
- Olea verrucosa*. — No. 36 059. An olive from Simondium near Paarl, Cape Province, Union of South Africa. Greatly resembles the European olive (*Olea Europaea*) which can be budded upon it: this will perhaps allow of the extension of the southern limit of olive-growing.
- Pistacia integerrima*. — No. 36 065: Introduced from Lahore, India as a possible stock for *Pistacia vera*.
- Prunus armeniaca*. — No. 35 701: an apricot from Monte Porcio Catone, near Rome, Italy. One of the best varieties known. Its cultivation in California is recommended.
- Prunus tomentosa*. — A Chinese bush cherry suited to the cold semi-arid parts of the North West of the United States. No. 36 103: from Tientsin, China: a variety with pale red fruits. No. 36 110: from the same place: has white fruit. No. 36 111: from Peking; fruit sour.

VINES.

- Vitis vinifera*. — No. 36 040: vine from Scharunpur, India, supposed to have come thither from the Punjab, and originally to have come from Afghanistan. Grapes seedless, of excellent flavour, but small in size.
- No. 36 041: a variety from Kabul, Afghanistan: fruit of large size and excellent quality.

II — The second list, Nos. 36 259 — 36 936, includes the seeds and plants introduced into the United States from October 1 to December 31, 913. Amongst the most important may be mentioned:

CEREALS.

- Triticum nudum*. — No. 36 675: a good variety of hull-less oats from Ta Shiang, Chihli Province, China, much cultivated in the higher mountain regions of northern China. A coarse flour is made from it.
- Triticum sativum*. — Nos. 36 546 to 36 548. Varieties of oats from different provinces of the Russian Empire.
- Panicum sorghum*. — Nos. 36 610 to 36 616: a good collection of varieties of sorghum from Do-

- doma, German East Africa; some have sacchariferous stems, others have edible grains giving good meal and beer. No. 36 639: "Dura sufa", from Khartum, Egyptian Sudan.
- Nos. 36 670 — 36 671: early-maturing varieties with dense heads and reddish-brown seeds, coming from Chihli Province, China. Fit for regions with short growing seasons.
- No. 36 672: dwarf variety of sorghum with large dense heads and white grains similar in origin and adaptation. Nos. 36 680 to 36 686: Sorghums from Victoria, Kamerun.
- No. 36 795: a tall-growing, white-seeded variety often producing several heads: from Chihli Province, China. No. 36 932: sorghum from Elim, German Southwest Africa.
- Nos. 36 935 and 36 936: sorghum from Carignan, Arlicennes, France (Denailhe et Fils).
- Hordeum vulgare*. — Nos. 36 345 and 36 346: barleys from Arequipa, Peru. No. 36 360: barley from Oruro, Bolivia.
- Oryza longistaminata*. — No. 36 533. Variety of perennial rice, (discovered by M. Ammann in French West Africa), from Jardin Colonial, Nogent-sur-Marne, France.
- Panicum miliaceum*. — An early-ripening millet with large yield, from Chihli Province, China. Fit for regions having short growing seasons.
- Pennisetum glaucum*. — No. 36 616: a variety from Dodoma, German East Africa. No. 36 655: variety from Nyassaland, Africa. No. 36 931: variety from Flim, German South-West Africa.
- Triticum* spp. — Nos. 36 388 to 36 390: wheats from Peru and Bolivia.
- Triticum aestivum*. — No. 36 392: wheat from Bolivia. Nos. 36 498 to 36 527: winter and spring wheats from Tashkend, Turkestan; very resistant to drought, even more so than *Triticum durum*. Nos. 36 577 to 36 587: wheats from Sydney, Australia.
- No. 36 622, "Gentile rosso" wheat from Bogliasco, Prov. of Brescia, Italy.
- Zea mays*. — Nos. 36 267 and 36 268: varieties of maize from Cuzco, Peru. No. 36 667: early ripening, flint maize from Pekin, China. No. 36 668: dwarf-growing white flint maize of early ripening habits from Hwai-Lai, Chihli Prov., China. Fit for regions with short growing season. No. 36 669: early ripening, dwarf maize with yellow flinty grain; suitable to same regions as the above. No. 36 699: maize with yellow flinty grain, very productive, comes from Barbados. No. 36 710: maize with yellow flinty grain: from Rio de Janeiro, Brazil. No. 36 711: Red Peruvian maize with large starchy kernels from Rio de Janeiro, Brazil. No. 36 712 White Peruvian maize with starchy kernels, also from Rio de Janeiro. Nos. 36 889 to 36 895: varieties of maize from Chihli Prov. China.

LEGUMINOSAE.

- Phaseolus angularis*. — Nos. 36 838 to 36 840: varieties of bean from Korea. Nos. 36 907; 36 910 to 36 912; 36 921 to 36 923: varieties from Manchuria.
- Phaseolus aureus*. — Nos. 36 909 to 36 920: varieties from Manchuria.
- Phaseolus coccineus*. — Nos. 36 476 to 36 478: varieties from Bolivia.
- Phaseolus lunatus*. — Nos. 36 479 and 36 481: varieties from Peru. Nos. 36 480; 36 482 to 36 484: varieties from Bolivia.
- Phaseolus vulgaris*. — Nos. 36 395 to 36 475; 36 861; 36 924: 85 varieties from Peru, Bolivia and Chile.
- Soja max*. — 38 varieties from Manchuria, China and Korea. Soja No. 36 785 is a wild variety from North China. The young pods are eaten boiled by the poorest Chinese; of value possibly as fodder plant when sown out among erect, growing plants, such as *Echinochloa frumentacea*, ("Barnyard millet").

FORAGE PLANTS.

- Agropyron* sp. — No. 36 792: a vigorously growing grass found at altitudes of 5 000 to 8 000 feet.
- Astragalus* sp. — No. 36 790 of value as a soil binder in semi-arid regions and perhaps for forage purposes.

- lymus dahuricus*. — No. 36 793 and *E. sibiricus*, No. 36 794 grow at altitudes of 7 000 to 9 000 ft.
- rodium* spp. — No. 36 789; produces abundant forage.
- cranium* sp. — No. 36 788: a biennial cranesbill producing an immense mass of forage eagerly eaten by horses, mules and donkeys.
- edicago ruthenica*. — No. 36 784 a wild lucerne from Chihli Province, China: a plant of spreading and semilascending growth. In moist places it forms a mass of herbage eagerly eaten by all grazing animals. It is found at elevations of 2 000 to 8 000 ft., and is most luxuriant at the highest altitudes.
- edicago sativa*. — Nos. 36 551 to 36 560: a collection of varieties from Poona, India.
- icia* sp. — Nos. 36 786 and 36 787: varieties of vetch from Chihli, China; very productive; suitable to cold climates and mountainous regions. The second is found at an elevation of 6 000 ft.

MEDICINAL PLANTS.

- riemisia maritima*. — No. 36 814: rich in volatile oil and in santonin. Comes from Russia.
- ularcea hexandra*. — No. 36 661: a little tree from 6 to 17 ft. high, coming from Puerto Bertoni, Paraguay. The bark is much used in Brazil and Paraguay, as its medicinal properties are similar to the Cinchona. Though a plant of warm regions, it stands a temperature of 3° to 5° C. below zero, and probably could resist a lower temperature.
- lanum aculeatissimum*. — Nos. 36 271 and 36 704; from Brazil. Can also be used as ornamental plants.

KITCHEN GARDEN PLANTS.

- paragus* spp. — Nos. 36 767 and 36 768: These 4 varieties of wild asparagus coming from China, (Pekin, and Province of Chihli), can be used in breeding experiments and for bank-binding purposes in semiarid regions. The young shoots of *A. dauricus* are eaten by the Chinese. *A. trichophyllus* is an ornamental plant.
- paragus dauricus*, No. 36 766. — *A. trichophyllus flexuosus* No. 36 769.
- ta vulgaris*. — No. 36 773: A chard coming from the Province of Chihli, China; suitable for alkaline soils.
- assica chinensis*. — No. 36 782; Summer cabbage from Kalgan, China.
- assica oleracea capitata*. — Nos. 36 299 — 36 300 — 36 302. Cabbages from Arequipa, — Chile.
- assica oleracea caulorapa*. — No. 36 770: very large variety of kohlrabi which can weigh as much as 25 lb. Comes from Chihli Province, China.
- assica Pekinensis*. — No. 36 781: early winter cabbage with light-yellow heart leaves: from Kalgan, China. No. 36 783: large winter cabbage, from Chihli.
- pticum annuum*. — No. 36 774: large, fleshy variety of Chile pepper suitable for alkaline soils: comes from Kalgan, China. No. 36 775: medium-sized pepper more pungent than former; from Kalgan, China. Nos. 36 776 and 36 777; strong peppers, elongated in shape; from same locality.
- scrobila maxima*. — An excellent squash from Lima, Peru. No. 36 778; large, ribbed yellow, winter squash with green blotches: suitable for alkaline semi-arid lands; comes from Kalgan, China. No. 36 779; squash suited for semi-arid soils; comes from the Province of Chihli, China.
- lakourshia Tacaco*. — No. 36 591: a cucurbitaceous plant from San José, Costa Rica; its fruit is one of the primitive foods of the Indians of Costa Rica, but it is also eaten by the Spanish Costa Ricans. The plant is cultivated, or semi-cultivated, on the central plateau.

- Raphanus sativus*. — No. 36 771; red, or green winter radish; comes from Chihli Province, China. No. 36 772; long, white, autumn radish from same locality.
Solanum quitoense. — No. 36 597; from Colombia: its fruit resembles a tomato.

ORNAMENTAL PLANTS.

- Acanthopanax* sp. — Nos. 36 733 and 36 734: spiny shrubs, met with at altitudes of 7 000 to 9 000 ft., from Chihli Province, China.
Albizia julibrissin. — No. 36 810: beautiful ornamental tree from Peking, China: can be used as shade-giving tree.
Amygdalus davidiana. — No. 36 807: wild pyramidal peach growing 50 to 60 ft. high: suitable for dry climates; appropriate for cemeteries to replace the cypress.
Artemisia sp. No. 36 797. — Biennial plant from Peking. Used in China as stock for chrysanthemums which, when thus grafted, are earlier and stronger. The introduction of *Artemisia* might extend the northern limit of chrysanthemum cultivation.
Berberis chinensis. — No. 36 737: an ornamental, dwarf barberry from the mountains of the Province of Chihli, China.
Cornus sp. — Nos. 36 741 and 36 742: Decorative mountain shrubs from above locality.
Hippophaë rhamnoides. — No. 36 743: buckthorn occurring on seashore of Europe and in the higher parts of Asia. Of value possibly as hedge plant for cold semi-arid region. From same locality.
Iris ensata. — No. 36 765: vigorously growing strain, from same locality: suitable for roadside plant in dry districts: is a good garden tying material.
Larix dahurica. — No. 36 728: mountain larch 6 000 to 10 000 ft.). Of value possibly as ornamental park tree for cooler regions.
Lychnis coronata. — No. 36 764: a perennial mountain *Lychnis* with brick red flowers: from the same locality.
Nitraria Schoberi. — No. 36 800: variety from Tientsin, China. Of value possibly as a soil and sand reclaimer for alkaline regions.
Ostryopsis Davidiana. — No. 36 731: a spreading ornamental shrub from Chihli Province, China. Of value as cover plant for banks and stony places.
Picea obovata. — No. 36 729: an ornamental, blue, mountain spruce from the same locality. Of value possibly for cold dry regions.
Prunus sp. No. 36 722: a wild shrubby plum, from the same locality. Possibly useful in hybridisation experiments.
Prunus humilis. — No. 36 721: plum similar to preceding from the same locality and suitable for same purpose.
Prunus padus. — No. 36 723: a mountain bird-cherry from the same locality. Of value for parks in cold regions. In Siberia, the fruits are eaten.
Prunus triloba. — Nos. 36 718 to 36 720: ornamental plums from same locality.
Rosa spp. Nos. 36 857 to 36 859: wild mountain roses from same locality—might serve in crossing experiments, or as stocks.
Sambucus racemosa. — No. 36 744: ornamental elder growing on poor soils: suitable for cold regions.
Sorbus sp. — No. 36 730: very ornamental mountain rowan from same locality.
Viburnum opulus. — No. 36 732: very ornamental snowball for cold regions: comes from same locality.
Viburnum plicatum. — No. 36 855: see above.

FRUIT TREES AND SHRUBS.

- Aleurites montana*. — No. 36 574: variety with oil-bearing seeds ("wood-oil-tree"), from southern China.

sydalis Davidiana. — No. 36 664: wild peach tree from Pekin, China. To be used for stocks for grafting.

nana cherimola X *squamosa*. — Nos. 36 562: Hybrid obtained at the Plant Introduction Station, Miami, Florida. Fruit excellent, flavour intermediate between that of the parents.

nana diversifolia. — No. 36 632: Red-fleshed anona from Mexico.

nana muricata. — No. 36 294: from Lima, Peru. — No. 36 532: from Honolulu, Hawaii. — No. 36 700 from Bridgetown, Barbados.

iris utilis. — No. 36 573: palm from San José, Costa Rica: the fruits, when cooked, have a taste much resembling that of the potato, they form in many places one of the principal foods of the Indians near San José.

beris heterophylla. — No. 36 626: edible species of *Berberis* growing on the foot hills of the Cordilleras and coming from Chubut, Argentina. Fruits edible, blue, with sweet taste resembling muscat grapes.

ata papaya. — 36 275 to 36 278: Four good varieties from Minas Gerais, Brazil.

gacus pinnatifida. — No. 36 801: A large-fruited variety of edible hawthorn from Pekin, China.

pyrus lotus. — No. 36 808: a wild persimmon from the same locality. Can be used as stock for grafting *Diospyros virginiana* and other varieties.

toma tomentosa. — No. 36 713: a variety from Rio de Janeiro, Brazil with orange-yellow, aromatic, juicy fruits.

crab sp. — No. 36 601: Crab apple from Shantung, China, admirable grafting stock.

No. 36 803. Crab apple with fruit the size of a large cherry, of dark purple colour making excellent compote.

myrtila. — No. 36 606: Mulberry from Rio de Janeiro, Brazil, may prove of value for the manufacture of jams and preserves.

aca americana. — Nos. 36 603 and 36 604: excellent varieties of avocado from Honolulu, Hawaii, whither they were imported from Guatemala. No. 36 687: a good variety from Lagos, Mexico.

ana sp. No. 36 607: very hardy plum; its yellow fruits have a fine aroma: comes from Sierra Leone.

ana chacholia. — No. 36 371: a wild cherry from Cuzco, Peru, where it grows at an altitude of 8000 to 9000 ft. Promises well as grafting stock for sweet cherries.

pe sp. — No. 36 802: fruits, very small pears of russet colour, with a long peduncle: comes from Pekin, China.

Elae orthocetala. — No. 36 561: Seeds obtained from the "Plant Introduction Field Station" of Miami, Florida. Grows on land which is often flooded at Para at the mouth of Rio de Amazonas and bears a delicious fruit resembling that of *Annona cherimola*.

ESSES P. H. DORSET, A. D. SHAMEL and WILSON POPENHOR made an exploring expedition to South Brazil at the end of 1913, and brought back the following species amongst others:

citrus sinensis. — Nos. 36 635; 36 637; 36 689; 36 691; 36 692, Bahia navel orange, from which has been derived the "navel Orange" cultivated in California (1).

citrus aurantium. — Nos. 36 636; 36 638; 36 707: "butter orange", Laranja da terra" of Rio de Janeiro should be grown in Florida and California.

chrysocarpa indica. — Nos. 36 688 and 36 811: the "Rosa mango" of Rio de Janeiro.

No. 36 680, the "Augusta mango" of the same locality.

Artocarpus cauliflora. — Nos. 36 702; 36 709; 36 888: the "Jaboticaba" of Rio de Janeiro; very common in Brazil, is one of the best and handsomest fruit trees. Should be cultivated in Florida and California.

PROF. S. C. MASON brought back from his scientific travels in Egypt and Nubia a collection of 12 date palms (2) growing in the Egyptian Sudan: *Phoenix dactylifera*, Nos. 36 676 to 36 818 to 36 828. He also discovered at Merowe, *Dodonaea viscosa* (No. 36 813), a subtropical plant used for hedges, which will be tried for this purpose in Florida and California.

At the end of 1913, MR. FRANK N. MEYER explored the Province of Chihli, China and brought back the following species, in addition to those already mentioned as coming from this province:

Amygdalus persica. — No. 36 805: A peach (from Pekin) with white fruit ripening in winter, flesh hard, but sweet. No. 36 806: peach (from Kalgan) fruit late, of good quality, but not very sweet.

Castanea mollissima. — No. 36 666: chestnut (from Pekin) of no use for timber, but seems more resistant to *Endothia parasitica* than the American chestnuts, therefore it might be used in hybridisation experiments to combine the good qualities of the American and Chinese parents into one tree.

Corylus sp. — No. 36 726 and 36 727: wild mountain hazels suitable for cold regions.

Prunus salicina. — No. 36 804: a variety of plum of wine-red colour, said to be as large as an apple. Of value possibly for the cooler sections of the United States.

VINES.

Vitis amurensis. — No. 36 753: very hardy grape from Chihli Province, China, where it is found at elevations of over 5 000 ft. (brought back by MR. F. MEYER). Fruits small, but edible. Of value as a porch and arbour vine; may be used in hybridisation experiments in order to obtain hardier vines for the colder sections of the United States.

19 — **The Determination of the Dry Matter in Beets.** — KRISTENSEN, R. K., Director of the Danish State Institution for Experiments in Plant Cultivation (Section of Chemical Investigation of Edible Plants).

Every year a large number of determinations of dry matter in roots are made in Denmark. Such determinations are associated with the various branches of investigation: the agrico-economic testing laboratory's investigations respecting fodder, the State testing operations for the cultivation of plants and the local field tests undertaken by the agricultural associations. In addition, dry matter determinations are made for improving roots for seed purposes and for controlling cattle-feeding (control associations). In addition to the laboratories associated with the State testing work, a number of private laboratories undertake determinations of dry matter for a moderate charge. As a rule the procedure is that indicated below as regards the main lines of investigation, and it is based upon various exhaustive tests. An account of the chief points of these tests is given with a more detailed description of the method itself.

In ascertaining the dry contents of roots the method of sampling is very important. Firstly one or more samples of the roots to be tested are taken, each sample consisting of a certain number of roots. From these specimens are again chosen, the plants being divided and samples drawn of the individual roots. The material thus obtained is then used for the final selection of specimens for the actual test.

(2) See B. August 1916, No. 573.

When drawing the first samples, as many roots must be taken as is sufficient to represent the whole number of roots to be tested for their dry matter. At first it was customary to draw samples consisting of three or four roots, but the result was so uncertain that the test was valueless, so that after a while larger and still larger specimens were taken, the maximum of about fifty roots being ultimately reached. A series of double analyses undertaken by the State testing stations in 1902 showed that the difference between two such samples could be as great as 0.5 per cent of dry matter. In 1903, L. HELWEG discovered that the dry contents of sixty samples taken from the same picked lot of mangolds varied from 13.67 per cent to 15.59 per cent. Each sample consisted of fifteen roots, and the standard deviation of the single samples was 0.36 per cent of dry matter. According

to the law of error this would make the standard deviation $\sqrt{\frac{0.36}{15}} = 0.20$

per cent. of dry matter, for samples of fifty roots. Subsequent calculations undertaken respecting a large number of determinations of dry matter in mangolds cultivated and analysed by the State testing stations in the years 1907-1909, showed that the average standard deviation in respect of single samples of fifty roots was 0.18 per cent of dry matter. If the roots are to be sent to a laboratory and probably kept for some time before the test can be made, a greater standard deviation may be looked for than when they are to be treated on the experimental grounds themselves. In 1909 R. K. KRISTENSEN tested 215 single roots (mangolds), and found that the variation in the dry contents of the individual plants account for the variations in that of the big samples. The weight of the roots varied from 102 grm. to 1745 grm and the dry content from 8.02 per cent. to 13.76 per cent. The standard deviation in the dry contents of the individual plants was 0.93 per cent, but if calculated in respect of roots of the same size, 0.84 per cent. The roots weighed on an average 817 grm. each, the average of dry contents being 10.88 per cent. If the standard deviation of the individual contents of dry matter be 0.84 per cent, the standard deviation in samples of 50 roots will be according to the law of

error $\sqrt{\frac{0.84}{50}} = 0.12$ per cent. At the testing station in Askov, where these

investigations were carried out, the actual standard deviation in the case of a large number of samples of fifty mangolds was 0.15 per cent of dry matter. The slight difference, 0.03 per cent, is easily accounted for by the fact that the 215 roots had grown side by side, whilst the samples of fifty roots referred to tests on comparatively large stretches of land. — Repeated tests have demonstrated that the small roots have a higher dry content than the large ones, and the samples drawn must be of the same average size as the roots which the test is to represent.

This can be done by drawing roots of medium size and also of various sizes. But calculations have demonstrated that the dry content arrived at will be somewhat too high, if medium-sized roots only are taken and

it is therefore advisable to make the desired test with roots of various sizes. In the case of very exact tests the very elaborate process has been resorted to of sorting out the roots into three classes according to size, and ascertaining the numbers of small, medium and large roots, after which the tests are compounded in accordance with the results obtained.

Formerly various methods were adopted for the testing of the individual roots. Cubes have been bored out of the roots or small pieces cut, or else a wedge-shaped incision has been made in one side of the root by means of a machine suitable for the purpose. But all these methods are defective, because the dry matter is not evenly distributed throughout the whole. The outside is richer in dry matter than the inside, and beets contain more dry matter at the two sides from which the fibres run than in the smooth parts between. The only correct method is consequently to saw the root through several times crosswise with a machine constructed by L. HELWEG and take out the final samples from the heap of parings. R. K. KRISTENSEN has found that the dry contents of the samples thus obtained correspond to the actual dry contents, when the saw is kept sharp and in good order; this has been confirmed by other tests. It also appeared that the final tests of the accumulated parings, the so-called pulp, can be carried out with great accuracy. Twenty-four samples were drawn from this pulp of about twenty grammes apiece. The dry contents varied from 11.45 to 11.56 per cent. The standard deviation of the individual samples was only 0.03 per cent of dry matter. A statistical treatment of a large number of determinations of dry matter undertaken by the State testing station at Askov from 1905-1911 substantiated this result.

The drying of the root pulp must take place at a comparatively low temperature. V. STORCH stated in 1905 that drying should be done at a temperature below boiling point, otherwise a partial separation of the pulp occurs, with the result that some of the dry matter is lost through the drying. A. MADSEN-MYGDAL AND P. CHRISTENSEN found subsequently that these conversions were associated with direct reducing sugars and that they caused a loss of dry matter about half as great as the diminution of the sugar contents. Therefore great care must be exercised in the drying of swedes and turnips, which practically contain nothing but direct reducing sugars. In beets the sugar is present in the autumn in the form of cane sugar, which stands drying at a higher temperature, but during the winter a portion of the cane sugar is split up into invert sugar which will not stand a high temperature.

There may be practical difficulties connected with drying at such low temperatures so that the said conversions of reducing sugars can be entirely avoided. In order that the results may be compared, the drying temperatures must be the same and kept as uniform as possible. Where there is a vacuum apparatus at hand, the samples can be dried much more easily under reduced atmospheric pressure. Permeating with gas would not, how-

Procedure adopted for determining dry contents of beets.

1. Taking samples.

Each test is made with fifty roots at least. Two, four or eight equal samples (joint samples) are drawn, according to whether very extreme accuracy is required or not. In comparing various roots, at the State testing stations four joint samples are used, but in the case of tests as regards feeding properties, eight. The taking of samples varies somewhat, according to whether they are needed for field tests and take place on the spot, or if they have to do with tests for feeding values, in which case the samples are drawn from a collection of roots. In the latter instance five hundred roots are counted out from the store of roots, one hundred roots being taken from five different places. The five heaps are weighed, and the average weight of fifty roots calculated.

For each analytical test ten roots are drawn from each heap, the idea being to have the different sizes represented in the sample, but the rare very large and very small roots are not included as such highly abnormal individuals could easily be too largely represented in the comparatively small sample. The samples drawn are weighed, and by exchanging small and large roots the weight is made to correspond to the average weight existing.

In the case of field tests the plan is usually adopted of weighing and counting the roots on each plot of ground before samples are drawn, and thus it is easy to calculate the mean weight. For each test equal numbers of roots are taken from each of the plots belonging to the same property, they being chosen, as in the previous instance, of different sizes. A sufficient number of roots are taken from each plot to make up an aggregate of at least fifty roots. The samples are weighed, and made to correspond with the average weight as before. If the roots cannot be analyzed immediately after being drawn, the samples are placed in hogs in the ground in such a way as to be protected from frost, earth being placed round each single root. Care must be taken that they do not dry between drawing and soiling up. As the dry contents can undergo alteration during storage this should not be protracted more than absolutely necessary. While the analysis is proceeding the samples are taken up as required from time to time.

2. Washing and sawing.

The roots are cleansed by means of a washing machine consisting of a vat two metres long filled with water, in which a drum containing the roots revolves. The drum is about 60 cm in diameter and calculated to contain a sample lot i. e. about fifty roots at a time. It is made of battens two cms. apart, and has a cover which is opened when the roots are put in or taken out. After being taken out of the washing machine, each root is carefully looked over, the earth adhering to it is removed with a sharp flat stick and a hard brush. Then the roots are laid out to drain off for several hours before they are sawn, being placed in flat crates or on a layer of straw.

The sawing is done with the above mentioned sawing machine consisting of a table on which is fixed a circular saw worked by hand or driven by power. The roots are cut transversely in slices of a certain thickness; the slices are brushed by the hand through an aperture in the table down into an oblique wooden shoot, down which they fall into a zinc box under the saws beneath the table. Half of the table can be removed and raised when the pulp is to be emptied out of the box, which can be unhooked from the machine. A tin screen is fixed over the saw to catch what it throws up. On the table a lath is placed, which makes it possible to maintain a regular distance between the cuts. The distance is regulated so as to get a suitable quantity of pulp (about 1 kg.) from each sample. Equal distance must be maintained between the incisions as long as each sample lot is being sawn, irrespective of the fact whether the root is large or small, or what shape it is. Five cms. will generally do.

The blade of the saw must not be too thick, preferably not over one mm. The teeth should be small (about two per cm) and oblique, as in an ordinary saw. They must be sharp, and set in such a way that the blade can pass freely through the beet. The teeth should be filed obliquely, so that the tooth projects in a point on the side on which it is set; if this is not done, the parings can easily hang together in long strips. The saw must not work backwards and the same speed must be maintained, therefore it is better for it to be driven by power than worked by hand. If the testing of the pulp cannot be done at once it should be put in a preserving glass or tin box with a tightly fitting cover, which must be kept until the final samples are weighed. This should be done, however, on the same day as the sawing.

3. *Drawing samples from the pulp and treatment of the samples selected*

The pulp is poured into a porcelain dish and carefully mixed. The soft and comparatively liquid pulp from mangolds is mixed by vigorous stirring, whilst pulp from the other kinds of roots which have a firmer consistence must be kneaded. The joint samples of 10-15 grms are taken out with a small spoon, the pulp being stirred again before each sample is drawn. The samples are put into cylinder glasses 60 mm. high and 45 mm. in diameter, having figures etched upon them. The 10-15 grms. of pulp put into each glass is distributed with the back of the spoon into an even layer on the inside of the glass. The easiest way to do this is to employ two men; one mixes the pulp and puts it into the glasses, the other weighs them. The samples are then placed in the drying apparatus. An ordinary thermostat is used with a water jacket and an automatic regulator. Where there is no gas on the premises, the thermostat can be heated by a petroleum lamp, but it is more difficult then to regulate the temperature. There must be an ample current of air through the thermostat, in order that the large quantity of vapour developed in the first stage of the drying can escape. Vapour should not escape from the drying chamber when the lid is taken

7. The samples should remain in the thermostat for twenty-four hours at a temperature of 80° C. They are then taken out and placed in dessicators over concentrated sulphuric acid. One must be satisfied perhaps by drying some of the samples again — that the drying has been complete. Incomplete drying can result from there being many samples in the chamber, with an insufficient air current, or if the samples are too large and the pulp is not carefully distributed in the glass. This may also occur if the regulating is defective and the temperature is allowed to drop. The samples are weighed upon an ordinary chemical balance, but others of a finer make can be used. The percentage of dry matter is calculated, and an average of the three joint samples from the same pulp is taken and then the mean figure for the two, four or eight samples of beets in the same category is arrived at.

8. — A Contribution to the Knowledge of the Chemical Composition of the Leaves of *Rubus*. — AUGUSTIN B., in *Botanikai Közlemények (Botanische Mitteilungen)*. Vol. XV, Nos. 3-4, pp. 94-96. (Author's Summary in German on pp. 29-30). Budapest, Nov. 4, 1916.

The Author has studied bramble leaves collected by school children in order to serve as a substitute for tea in the army. In 1914 nearly 1970 plants were collected from about 12 000 localities in Hungary. The material sent to the Author was very varied, for under the name "bramble-leaf" numerous species of *Rubus* together with numerous hybrids had been collected. Two chief types could be separated from the whole: 1) leaves from low-lying land, usually belonging to the group of *Rubus caesius*; 2) leaves coming from hilly land and approximating to the group of *R. tomentosus*.

A large number of analyses were carried out; the results showed much variation, as might be expected from such heterogeneous material; the outside values were as follows:

The dry leaves of *Rubus* were very hygroscopic, their water-content varying according to the season: on dry days varying from 5.3 to 6.8%; on rainy days from 8.5 to 9.17%.

The ash-content of leaves incinerated at 100° C. varies from 5.24 to 5.3%.

The water extract varies between 38.6 and 43.32%; its ash-content between 8.48 and 9.21%.

The total nitrogen obtained by the KJELDAHL method, varies between 2.52 and 2.73%; the crude protein calculated from the total nitrogen ($N \times 6.25$) between 15.8 and 17.0%.

The tannin content was estimated by titrating with $\frac{N}{10}$ potassium permanganate solution, assuming 4 mg. of permanganate as equivalent to 1 mg. of tannin. By this means, 9.3 to 12.8% of substance oxidisable by the permanganate was obtained, but about one third of this amount is not tannic, for if the tannin is eliminated by adding powdered leather, there still remains matter oxidisable by permanganate, excepting that absorbed by the powdered leather.

Some leaves after drying had a delicate aroma, similar to that of tea others, on the contrary, were devoid of any aroma. Leaves moistened with water and left to macerate in a warm place assumed a peculiar flavour somewhat like coumarin. The appearance of this aroma is probably related to the action of hydrolytic ferments similar to those found in *Rhizaceae*.

The high albumen content of the leaves suggested their utilisation as forage. The Director of the Zoological Garden at Budapest tried some feeding experiments with these leaves, and found that they were eaten with relish by deer.

- 21 - **A Bacterial Test for Plant Food Accessories (Auximones).** — BORTOMLEY W. R. in *Proceedings of the Royal Society (Biological Sciences)*, Series B, Vol. 80, No. B 610, London, August 2, 1915.

The nutrition of a plant depends, not only on the supply of mineral food substances, but also upon the presence of certain accessory food substances, or auximones (= promoting growth), very small amounts of which are sufficient to satisfy the needs of the plant. Hitherto the only means of demonstrating the presence of auximones has been their action on the higher plants. Experiments showed that the auximones in bacterised peat produced an increase in soil nitrification. This suggested that liquid cultures of the nitrifying organisms might provide a test for plant auximones. It was further found that a scum was always formed on the surface of the liquid whenever the auximone was added to the crude nitrifying culture from soil. The organisms forming the scum are, as yet, unidentified, but they are widely distributed in soil, and easily obtained. Again, the amount of scum formed was found to increase progressively with the quantity of auximone present above a certain minimum. More extensive tests showed that the scum formation is due to the specific action of auximones. The accessory substances concerned with animal nutrition were also found to induce scum formation. Thus, it is evident that the scum-forming organisms can serve as a qualitative test for food accessories in general. Having the indicator for auximones, other material can be examined for their presence.

Auximones were found in the root nodules of leguminous plants. The scum-forming organisms require no organic carbon for growth and, like nitrifying organisms, can assimilate atmospheric carbon dioxide by chemosynthesis. Further, they are obliged to obtain their nitrogen from an ammonium salt, as they cannot make use of nitrates.

The plant auximones so far investigated differ from those concerned with animal nutrition in that they are not destroyed by heat, as they can withstand a temperature of 134°C . for half an hour without losing their properties.

- 22 - **The Relation of Transpiration to Assimilation in Steppe Plants.** — HJUN V. S. in *The Journal of Ecology*, Vol. IV, No. 2, Cambridge, June 1916.

The results of numerous researches made by the writer on the steppe reservation in the Government of Voronezh, for the purpose of studying

the relation of transpiration to assimilation in species of plants growing in arid regions.

When the decreased intensity of the transpiration process, by which the plant reduces its water consumption, is due to the partial closing of the stomata, a smaller quantity of carbon dioxide is absorbed and consequently the assimilation is diminished. For this reason, a plant will be better adapted to growing in dry places, the more it is provided with protective arrangements which allow it to reduce the loss of water to a minimum even while keeping the stomata open and without interrupting assimilation. Such protective devices are the sinking of the stomata, hairiness, and reduction of the evaporating surface.

Without mentioning the technical details of the experiments, we may summarise the most important results as follows:

1) Plants possessing xerophytic organs (xerophytes) lose less water per unit of decomposed carbonic acid than plants living in a damp locality (mesophytes). Thus for every cc. of carbonic acid decomposed *Stipa capillata* (arid steppe) lost 160 cg. of water; *Coronilla varia* (grass steppe), with a ratio of 100 : 14, lost 1176 cg. In another experiment, *Stipa capillata* only lost 125 cg. and *Aristolochia clematitis*, a true mesophyte, lost 544 cg. Naturally, the plants examined were kept under uniform conditions during all these experiments. 2) Mesophytes must close their stomata in dry places, in order to reduce evaporation, thus also diminishing the rate of assimilation, whereas in the case of xerophytes, assimilation in similar circumstances proceeds actively. Under normal conditions, *Geranium pratense* (mesophyte) assimilates 24.54 cc. of CO_2 ; *Stipa capillata* 7.91 cc.; *Phlomis pungen* (arid steppe), 7.84 cc. In other experiments we have, *Senecio doria* (meadow steppe), 14.71 cc., *Phlomis pungen* 6.60 cc. On the other hand, when *Geranium pratense* is transferred to the arid regions of the steppe, the intensity of the assimilation process may entirely cease; in the case of *Senecio doria*, the amount of carbonic acid assimilated falls from 14.71 cc. to 2.14 cc., while *Stipa* and *Phlomis* continue to develop normally. Thus we find that mesophytes, on being transferred to a dry place, reduce their assimilation till it is even less than that of xerophytes.

3) In consequence of the greater amount of moisture in the environment, mesophytes lose, under normal conditions, less water per unit of time than xerophytes; if however the mesophytes were transferred to dry places, their transpiration would increase to a greater extent. In the case of *Senecio doria*, the loss of water per unit of CO_2 was doubled, in the case of *Geranium pratense*, it was 3 times as great; in *Galeopsis ladanum* almost 10 times, and in *Aristolochia clematitis* about 31 times.

Taking as a basis their higher or lower degree of xerophily, the writer divides the species examined by him into the following groups.

- 1) *Aristolochia clematitis* and *Galeopsis ladanum* in wet hollows where rain collects most and remains longest.
- 2) *Geranium pratense*, *Trifolium montanum* and *Betonica officinalis*, in shallow ravines and the meadows bordering them.

3) *Senecio doria* and *Coronilla varia* on meadow steppes.

4) *Centaurea orientalis*, *Amygdalus nana*, *Caragana frutescens* and *Stipa capillata* in the drier and more elevated parts of the steppe.

The conclusions reached by the writer and the method he has devised are of considerable importance, not only to physiology in general, but also from the point of view of the selection of drought resistant types. The transpiration factor alone is not a sufficient criterion. A rather low transpiration index only shows that the plant, or species in question loses little water, but gives no information as to its powers of assimilation, and therefore of its productivity. The breeder of maize should thus not limit his choice to the selection of individuals with a low rate of transpiration (those resistant to drought) but, on the contrary, aim at the creation of types which combine feeble transpiration (*drought resistant*) with relatively intense assimilation (*highly productive*).

23 - The Relation of Soil Moisture to Transpiration and Photosynthesis in Maize. —

YUNCKER T. G., in *Plant World*, Vol. 20, No. 6, pp. 151-161, Baltimore, Md., June 1911

Experiments to determine the relation between the amount of transpiration and of photosynthesis in corn plants and the degree of soil moisture in which they were grown. The soil moisture was kept at three degrees, viz: 25, 45, and 65 per cent of total saturation.

The amount of transpiration was obtained by continuous weighings of potometers, and the water used by the plants was recorded. The amount of photosynthesis was determined by measuring the weights of a given area of the plants at fixed intervals. To prevent evaporation, glazed potometers were used and the soil surface was sealed with wax, the young maize plants being protected by paper. At the end of the experiment the soil showed a loss of from 1 to 5 % of the initial moisture. The relations between transpiration per unit of leaf area and soil moisture are shown in two tables. It was found that the water requirement was less for plants in the drier cultures in all experiments, being least in the 25 per cent, most in the 65, and intermediate in the 45 per cent. The rate of transpiration in grams of loss per sq. metre per hour showed the same relation to moisture content as did the water requirement. Thus it appears that the amount of organic matter formed is not proportional to transpiration. The amount of transpiration varied much from day to day, but was approximately constant for the three series. The variations may be ascribed to environmental changes.

The photosynthetic experiments were designed so as to find the relation between the weights per unit area of leaf surface at different periods of the day and at the 3 degrees of soil saturation. Plants in the dry soil weighed most per unit area, the medium next, and the wet the least. The maximum increase in dry weight per unit area took place about noon and then decreased towards evening. After dark the unit dry weight gradually decreases till daylight, the maximum loss occurring before midnight. The relation between the three cultures remained about the same for the 24 hours.

- 14 - Germination Tests of the Seeds of Garden Cress (*Lepidium sativum*) under very varied Conditions. — LESAGE PIERRE, in *Comptes Rendus des Séances de l'Académie des Sciences*, 1916, Second Half-year, Vol. 163, N° 18, pp. 486-489. Paris, October 30, 1916.

The results of numerous experiments carried out at different times.

In potash solutions. — This test shows a method for indicating the germinating power of seeds without awaiting their actual germination. On placing in a $\frac{1}{128}$ N. potash solution, the seeds that colour the solution yellow will not germinate, while those causing no coloration will germinate.

In alcoholic solutions. — Tests with alcoholic solutions of varying dilution showed that the limits of germination are expressed by a curve formed by taking the length of immersion for the ordinates and the amount of dilution for the abscissae.

The curve is concave at the top and shows three interesting points, the most important being that which corresponds to the limit of germination after immersion in absolute alcohol. It corresponds to the dilution zero and to an undetermined time, but which exceeds 4 years 7 months. It is thus evident that seed may be kept for a long time in absolute alcohol without injuring the germinating power.

In saline solutions. — Tests in solutions of chlorides, nitrates, sulphates of potassium, sodium, ammonium, resulted in curves similar to those of alcohol. Formed by taking the gram-molecular concentration as abscissae, the curves are far from coinciding; it may be deduced that, if the osmotic pressure of these solutions comes into play, it does not control the phenomena alone. On the other hand, in finding the limit of gram-molecular concentration below which germination will still commence in the saline solutions, and above which germination is stopped, it is found that the limit is about 0.4 mol., showing that osmotic pressure plays an important part in the germination.

Influence of the method of sampling, the duration of immersion, of the germinating chamber. — In tests after prolonged immersion in alcoholic solutions, in saline solutions, or even in spring water, the method of sampling and the length of immersion, time during which the embryo may asphyxiate, and the death of the embryo may result from the exosmosis of more or less toxic products, must be taken into account.

The tests of seeds taken out of the solutions being made in a germinating chamber, the nature of the chamber influences the results. Germination takes place better between moist blotting paper than in wet moss, in damp earth or on a thin film of water. Between boiled blotting-paper it is still better. Finally, on a thin film of oxygenated water, suitably dilute, germination takes place when it will not do so under other conditions.

In petroleum ether and ordinary ether. — Garden cress seeds still retain the power of germinating after remaining 4 years 7 months in petroleum ether. Their germination power is quickly lost in ordinary ether.

In moist air. — On flame-sterilised paraffin floats, floating on distilled

led water in a glass-box hermetically sealed, the seeds of *Lepidium sativum* could germinate; but there are large individual differences and the germination number depends on the temperature, so that, even at about the optimum temperature (21° C), the variation could be considerable.

Seeds that had not germinated with a water-saturation equal to 1 had not lost their germination power after 5 months. Garden cress seed did not germinate in damp air with less water saturation than 1, for instance equal to 0.98. As regards age, 1 month old seed had not germinated after 20 days, with water saturation unity, when grains of 1 to 5 years germinated after the third day under the same conditions.

In oxygenated water. — Old or young seed, but more or less altered by the medium in which they were placed, can still germinate in oxygenated water suitably diluted and renewed, while they germinate badly or not at all under other conditions.

An experiment on old seed gave: out of 10 seeds, 8 years old, after 14 days on spring water, between moist blotting paper, on water with 0.45 vol. of oxygen, 5 produced 1 to 2 mm. of radicle in the first case; 6 produced 2 to 5 mm. of radicle in the second, and 5 have freed the young plant in oxygenated water. In solutions obtained by diluting water containing 6.8 vol. of oxygen by $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, etc., germination still took place in the $\frac{1}{4}$ strength dilution, but not in the $\frac{1}{8}$ strength. The action of the oxygenated water is improved by renewing the water every day; it should be noticed that, in cultures on a thin film of water, changing the water every day produces similar effects.

Oxygenised water, suitably diluted, at first favours germination, but the young plants are retarded in their development, remaining short and squat (1).

Graduated Germination. — Seed that had commenced germination in moist air at a water saturation of 1, then placed in a water saturation of 0.87, ceased germinating; after 10 days stoppage, the same seeds recommenced germination after being placed between moist blotting paper. The author has thus obtained "interrupted germination" so called by TH. DE SAUSSURE, but by another method.

25 - On the Inheritance of Certain Stem Characters in *Sorghum*. — HUNSON G. S. (Deputy Director of Agriculture, Northern Division, Madras Presidency) in *The Agricultural Journal of India*, Vol. XI, Part II, pp. 100-155, 1 plate, Calcutta, April, 1916.

Attention has already been drawn (2) to the occurrence in some strains of selected *sorghums* of two distinct types differing as regards the appearance of the midrib of the leaf. In one the midrib appears as an opaque white band running the whole length of the leaf, while in the other the mid-

(1) Compare DENOUESSY, Influence of oxygenated water on Germination in *Comptes Rendus de l'Académie des Sciences*, 1916, Vol. 162, N° 12, pp. 435-438. The author continued his experiments through reading this communication.

The communication is abstracted in *B.* June 1916, N° 627.

(2) BENSON and SUBBA RAO. The Great Millet or Sorghum in Madras. *Bull. Dept. Agr. Madras*.

rib of the lower leaves is marked by a dull white, generally broken, band, never extending across the full length of the midrib and rarely to the end of the leaf; in the upper leaves the midrib is devoid of any white marking whatever.

A greyish midrib has been definitely shown to be associated with a stem rich in sugar, a white midrib to be associated with a dry pithy and tasteless stem.

Tests have now been carried out on the inheritance of these characters with the result that the pithy character of the stalk has been shown to behave as a simple dominant to the sweet-stalked character. The differences in the characters of the midribs of the leaves do not become apparent in the plants until these latter are about 6 to 7 inches high.

2b - Studies on the Correlation of Characters in the Oat Plant, in U. S. A. — LOVE H. H. and LEIGHTY C. E., in *Cornell University Agricultural Experiment Station, Memoir No 3*, pp. 1-70, Ithaca, N. Y., 1916.

The numerous researches on oats have undoubtedly contributed considerably towards their improvement but a great deal yet remains to be learned as to variation in this plant and correlation of its characters. For instance, we are still ignorant as to whether there exist characters capable of providing a sound basis for selection or if, speaking generally, the whole of the anatomical characters vary during the progress of the season to such a point as to exclude their use as a means of progressively improving the plant. Similarly with regard to correlation of characters: it still remains to be seen whether characters capable of correlation are subject to changes in their mutual relations from year to year following seasonal changes, or whether, on the other hand, they are sufficiently stable to furnish a sound basis for the breeder. One is stimulated to put the following questions:

- 1) Do the tallest plants produce:
 - a) the largest amount of seed?
 - b) the biggest grains?
- 2) In proportion as the culms increase in number:
 - a) is there a corresponding increase in the yield of grain per culm?
 - b) does the average number of grains per culm increase or diminish?
 - c) does the average weight of a grain increase or diminish?
- 3) Do these various relationships remain unchanged from year to year?

In order to answer the above questions researches were made into the variation and correlation of various characters in the oat plant, even under varying environmental conditions, during the period 1909-1912. The whole of the material examined was derived from a pure strain of the "Sixty-day" variety, isolated and sown in 1907. In 1909 analyses were made of 60 entire plants; in 1910 and 1912, of 400 plants (1). No material was examined in 1911, the crop in that year having suffered too much damage from storms.

(1) In 1908 only the culms were examined, 825 in number.

TABLE I. — Correlations between "average length of a plant" and "grain yield per plant" observed in 1909.

Height of plants	Grain yield per plant													Total number of plants
	0-1 gr	1-2 gr	2-3 gr	3-4 gr	4-5 gr	5-6 gr	6-7 gr	7-8 gr	8-9 gr	9-10 gr	10-11 gr	11-12 gr	12-13 gr	13-14 gr
40-45 cm	1													1
45-50 cm	2	1												3
50-55 cm	5	3												8
55-60 cm	1	6	1											11
60-65 cm	7	10	9					1						36
65-70 cm	3	18	26	12	1									60
70-75 cm	4	10	42	26	10	3	2	1	1	1				94
75-80 cm	2	4	14	38	23	6	5	5					2	99
80-85 cm			1	22	32	19	11	10	5			1	1	102
85-90 cm		1		4	13	17	17	9	4	1	2			68
90-95 cm					2	2	5	5	1		2	1		18
Total number of plants	25	62	116	160	81	17	40	31	10	2	5	2	1	500

Height of plants

TABLE II. Correlations between "average height of a plant" and "average weight of a grain observed in 1910.

Average weight of a grain														Total number of plants	
	115 to 125 mg	125 to 135 mg	135 to 145 mg	145 to 155 mg	155 to 165 mg	165 to 175 mg	175 to 185 mg	185 to 195 mg	195 to 205 mg	205 to 215 mg	215 to 225 mg	225 to 235 mg	235 to 245 mg		
45-50 cm							1	1						2	
50-55 cm		1	2	1	1	3			1					9	
55-60 cm			1	1	3	7	4	2	1	1	1			21	
60-65 cm		1	1	3	7	8	10	2		1	1			34	
65-70 cm		1	5	13	13	24	24	9	5	2	1	1		97	
70-75 cm		1	3	12	31	30	24	11	5	5	1			123	
75-80 cm	1		3	16	14	25	13	10	6	1				89	
80-85 cm			1	4	3	6	7	2	1					24	
85-90 cm														0	
90-95 cm							1							1	
Total number of plants	1	4	16	50	72	103	83	37	10	10	4	0	1	400	

Average heights of plants

Among biometrical data determination was made of the following values:

- 1) *Number of stems per plant*
- 2) *Average height of a plant* (sum of the lengths in cm. of all the culms, from the surface of the soil to the base of the apical spikelet, divided by the number of culms of a single plant).
- 3) *Total yield of grain per plant* (total weight of grains expressed in grams).
- 4) *Average yield of grain per culm* (total yield of a plant divided by the number of culms).
- 5) *Total number of grains per plant*.
- 6) *Average number of grains per culm* (total number of grains of a plant divided by the number of culms).
- 7) *Average weight of a grain per plant* (total weight of the grains divided by their total number; quotient expressed in milligrams).
- 8) *Total number of spikelets per plant*.
- 9) *Total number of spikelets per stem* (total number of spikelets on a plant divided by the number of stems).
- 10) *Average number of grains per spikelet in a plant* (total number of grains of a plant divided by the number of spikelets).

I. CORRELATIONS BETWEEN THE "AVERAGE LENGTH OF A PLANT" AND THE REMAINING CHARACTERS.

1) *Correlation with "total grain yield per plant."* — This is illustrated by Table I, in which are arranged the data obtained in 1909. In this double entry Table the "average lengths" every 5 cm., starting with 40 cm., are arranged as ordinates, in the first column on the left, outside the frame. The "grain yields per plant" in grams, are arranged as abscissae above the frame. Within the frame are inscribed the numbers of plants which show in each case such or such combination of "average length" and "grain yield." For example, the number 11 placed in the 7th column from the left, 9th line, shows that, among 500 plants examined, 11 have an average length of between 80 and 85 cm., and a grain yield of between 6 and 7 gr. Outside the frame, below and to the right, are placed the respective totals of plants for each category of length and of yield; in the south-east angle is placed the total number of plants examined: 500. — Tables II and III show a similar arrangement. Table I shows a very distinct correlation between "average length of a plant" and "total grain yield of a plant." The coefficient of correlation is 0.689 ± 0.016 in 1909. In 1910 and 1912, a similar correlation was observed but, in this case it was less distinct.

2) *Correlation with "average grain yield per culm."* — The foregoing is positive for the 3 years under observation with a maximum coefficient of 0.850 ± 0.008 in 1909. The minimum weight of grains per culm: 0.1-0.2 gr. was observed in a single plant, 40-45 cm. in height; the maximum weight: 1.8-1.9 gr. also in a single plant, 85-90 cm. in height. Between these

limits, there is a more or less regular relationship between increase in length of stem and increase of weight of grains per stem.

3) *Correlation with "total number of grains per plant."* — This varies from 0.487 ± 0.026 in 1910 to 0.676 ± 0.016 in 1909.

4) *Correlation with "average number of grains per plant."* — Varies from 0.658 ± 0.013 in 1908 to 0.835 ± 0.009 in 1909.

Thus in the two cases 3) and 4) there is a high degree of distinct and stable correlation. As the height increases the average number of grains increases with it, whether per plant or per culm.

5) *Correlation with "average weight of a grain per plant."* — This is illustrated by Table II containing the data for 1910. The coefficient varies from -0.023 ± 0.034 in 1910 to 0.555 ± 0.016 in 1908, i. e. from complete absence to a high degree of correlation. The ratio between "average weight of a plant" and "average weight of a grain" may be either very arrow, or in some cases on the other hand may be modified in such a way that the two characters may be perfectly independent of one another. This was observed in 1910: e.g. to the weight 18.8 - 19.5 mg. there correspond heights varying from 45-50 cm. to 80-85 cm.; conversely, to a height of 65-70 cm., for example, there correspond weights varying from 2.5 - 13.5 mg. to 23.5 - 24.5 mg.

6) *Correlation with "number of culms per plant."* — Varies similarly to the preceding, the coefficient of variation being comprised between 0.042 ± 0.034 and 0.523 ± 0.024 .

7) *Correlation with "number of spikelets per culm."* — This, on the contrary, is stable and gives a high coefficient comprised between 0.609 ± 0.012 and 0.817 ± 0.010 in 1909.

II — CORRELATIONS BETWEEN "TOTAL GRAIN YIELD PER PLANT" AND THE REMAINING CHARACTERS.

1) *Correlation with "average yield per culm."* — This correlation is very distinct and stable one, the coefficient being comprised between the arrow limits 0.602 ± 0.018 and 0.761 ± 0.013 in 1909, but owing to the uneven mode of growth in the oat plant the correlation is not perfect: some stems develop to a greater extent than others, in such a way that the plants with numerous stalks often give a relatively low yield per stalk.

2) *Correlation with "total number of grains per plant."* — Distinctly positive: the coefficient varies from 0.918 ± 0.005 in 1910 to 0.998 ± 0.001 in 1912. The plants with yields of 1-2; 11-12; 19-10 gr. bear 100-150; 60-800; 1200-1300 grains respectively.

3) *Correlation with "average number of grains per plant."* — Similar to the preceding though perhaps somewhat less distinct.

4) *Correlation with "average weight of a grain per plant."* — This is very variable and always somewhat low, as shown by the coefficients 0.035 ± 0.034 in 1910 and 0.220 ± 0.032 in 1912. Good and bad bearing plants often carry grains of equal average weight: thus grains weighing

16.5 - 17.5 mg. are found throughout a whole series of plants the yield of which varies from 0.1 to 6.7 gr.

5) *Correlation with "number of spikelets per culm."* — Positive and high. The greater the number of spikelets per culm the higher the grain yield.

6) *Correlation with "number of culms per plant."* — Positive, the coefficient varying from 0.712 ± 0.017 in 1910 to 0.912 ± 0.006 in 1912.

III. CORRELATION BETWEEN "AVERAGE WEIGHT OF A GRAIN PER PLANT" AND THE REMAINING CHARACTERS.

1) *Correlation between "average weight of a grain per plant" and "average weight of a grain per culm."* — This is very low and varies considerably from year to year: from 0.225 ± 0.032 in 1910 to 0.464 ± 0.018 in 1908. Nevertheless it is always superior to the correlation between "average weight of a grain per plant" and "total yield per plant."

2) *Correlation with "total number of grains per plant."* — The coefficient varies from -0.253 ± 0.032 in 1910 to 0.071 ± 0.034 in 1912.

3) *Correlation with "total number of grains per culm."* — The coefficient varies from -0.172 ± 0.033 in 1910 to 0.300 ± 0.021 in 1908.

These correlations 2) and 3) vary considerably from year to year, while remaining, on the whole, very low, to the extent of being occasionally negative. The number and weight of the grains may increase without being accompanied by corresponding modifications of the other characters.

4) *Correlations with "average number of spikelets per culm" — "average number of grains per spikelet" — "number of culms per plant."* — Very variable and subject to fluctuation.

IV. CORRELATIONS BETWEEN "AVERAGE NUMBER OF SPIKELETS PER CULM" AND THE REMAINING CHARACTERS.

1) *Correlation with "average number of grains per spikelet."* — Positive: the coefficient varies from 0.253 ± 0.032 in 1910 to 0.324 ± 0.027 in 1909.

2) *Correlation with total number of spikelets per culm."* — Still narrower: in 1908 the coefficient is 0.880 ± 0.005 . The data obtained in that year are arranged in Table III.

V. — CORRELATION BETWEEN THE "NUMBER OF CULMS PER PLANT" AND THE REMAINING CHARACTERS.

1) In a particularly favourable environment, the increase in the number of culms is accompanied by a corresponding increase in: the height of the plants — the average grain yield per culm — the average number of grains per culm. But these correlations are always rather low, fluctuating and may sometimes disappear completely.

2) The increase in the number of stems is also accompanied by an increase in the total grain yield per plant.

3) The "number of stems" and "the average weight of a grain" vary independently of each other.

CONCLUSIONS.

It results from the foregoing that certain characters may furnish a good basis for the work of selection.

TABLE III. — *Correlations between "average number of spikelets per culm" and total number of grains per culm", observed in 1908.*

	Total number of grains per culm.											Totals of culms
	1-10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100	100	
1-5	33											33
5-10	63	123										186
10-15	7	120	87	1								215
15-20	2	17	132	36								187
20-25	1	7	18	78	14	5						123
25-30		1	1	17	29	6	1	1				50
30-35					3	6	4	1				14
35-40						1	2	1	3			7
40-45								2		1		3
45-50										1		1
Total of culms	106	208	238	132	46	18	7	5	3	2		623

1) The variable nature of the meteorological factors influences the numerical values, producing more or less marked oscillations about the mean values. The conditions which bring about a reduction in the grain yield also determine a diminution in: the height of the plants - the number of grains - the number of stems -- and increase in the size of grains.

2) Decrease in the number of grains has greater influence on the yield than decrease in size of the grains.

3) Decrease in the values and mean coefficients is accompanied by decrease in the variability.

4) The correlations are classed as "fluctuating" or "stable" according to their greater or less degree of sensitiveness to external factors

5) For example, high, positive and stable correlations are observed between the "average height of a plant" and: a) "total and average yields;" b) "total and average number of grains;" c) "average number of spikelets per culm." On the other hand, fluctuating correlations occur, high in some cases, very low in others, between "average length of a plant" and: a) "average weight of a grain;" b) "number of culms."

6) The "total grain yield per plant" is in close correlation with: a) "yield per culm;" b) "total and average number of grains;" c) "number of spikelets;" d) "number of culms."

7) The "average weight of a grain" is only correlated to "average yield per culm" and to no other character.

8) The "average number of spikelets" per culm is in close correlation with: a) "average number of grains per spikelet;" b) "number of grains per culm;" c) "average height of a plant;" d) "yield of a plant."

a) As regards correlations between "number of culms per plant" and other characters, the following observations have been made:

With: a) "average height of a plant;" b) "average yield per culm;" c) "number of grains," fluctuating and variable correlations.

With "total yield of a plant," stable and positive correlation.

With "average weight of a grain" a correlation usually positive but always very low.

In short, in order to increase the yield of oats, preference should be given to those plants which are tallest and bear numerous spikelets each of which is well provided with grain. There is no need, however, to attach much importance to the size of the grains as these latter often given high values even on small, poorly productive plants.

27 - **Correlative Characters of the Rice Plant.** — JACOBSON H. O. (Chief, Plant Industry Division), in *The Philippine Agricultural Review*, Vol. IX, No. 2, pp. 77-119, Manila 1923.

The results of numerous researches made by the writer in the Philippines from 1909 to 1913, on the correlations existing between the anatomical and physiological characters of rice, the duration of the growth period and the yield of grain.

Average duration of growth period (from sowing to complete maturity of the grain) and the yield of paddy. — Table I gives the most important data regarding this subject.

When the growth period is not less than 120 days, or longer than 180 it has no appreciable effect upon the yield. On the other hand, great precocity is nearly always accompanied by a decrease in the yield, as can be seen from the many experiments carried out with varieties of both low land and upland rice which mature in less than 120 days (minimum 100 days), but always have a much lower yield than other varieties with a growth period lasting from 30 to 45 days longer. Equally unsatisfactory results are obtained from varieties that ripen very late, since the time of maturity

TABLE I. — *Correlation of duration of growth period and yield of paddy.*

Occurrences	Duration of growth period	Average yield of paddy per hectare
5	114 days	829 kg.
16	124.8	1 849
88	135	1 715
133	144.8	1 903
129	154	1 748
133	169	1 966
166	174.3	1 995
163	184.5	1 846
89	193.5	1 376
87	210.2	1 024

often coincides with unfavourable weather conditions and opportunity is afforded to diseases and pests to injure the plants and thus lower the yield of grain.

Tillering and yield of paddy. — As the number of culms per plant increases, the yield also increases. The true significance and value of the tillering character is not yet fully realised, but it may be regarded as very desirable. Scanty tillering may be remedied by very thick planting. Table II gives a summary of the correlation observed between tillering and yield of paddy.

TABLE II. — *Correlation of tillering and yield of paddy.*

Occurrences	Average of culms per plant	Average yield of paddy per hectare
3	2.7	561 kg.
44	3.6	1 007
208	4.4	1 342
283	5.4	1 776
249	6.4	1 889
137	7.4	2 201
38	8.3	2 415
10	9.4	2 521
6	10.4	2 214
1	11.9	2 797
1	12.6	2 373

In these calculations, it must never be forgotten that tillering, the number of grains per panicle, and grain or seed size, are elastic or compensating characters, thus a large number of seeds per panicle may correspond to a small number of culms; on the other hand, a small number of grains per panicle may be counter-balanced by the better development of each grain due to different organic requirements, or to the meteorological conditions obtaining during the various phases of growth.

Length of culm and yield of paddy. — Table III summarises the most important data on this subject.

TABLE III — *Correlation of culm length and yield of paddy.*

Occurrences	Average length of culms	Yield of paddy per hectare
41	1 058 mm.	1 150
45	1 143	1 268
101	1 257	1 423
183	1 350	1 560
163	1 445	1 652
169	1 548	2 060
133	1 648	1 811
86	1 747	2 018
50	1 840	2 296
13	1 944	2 025
2	2 060	1 750

Within certain limits, at least, the increase in the culm length is associated with greater productivity. In selection work, it is advisable to take 1.5 m. as the standard culm length; by selecting short-stemmed varieties, plants of low yielding capacity are obtained. Further it is not a fact that varieties with short culms resist lodging best, for the ability of a plant to withstand high winds depends upon the culm structure and its distribution. In the case of all varieties, but especially in that of the tall kinds, the culm length varies from one year to another according to the season, but when the deviations from the average are very great in either direction a perceptible loss in yield results.

The number and shape of the grains and the length of the growth period. The shape and the number of grains in the panicle have little effect upon the yield. Varieties with 100 grains per panicle can produce as large a crop as those with 300 grains per panicle. Varieties having long, slender grains may give as high a yield as those bearing short plump grains. On the other hand, grain length has a positive correlation to the maturing period, the

longer the grain, the more time the variety requires to ripen. This is shown in Table IV.

TABLE IV. *Correlation of grain length and duration of growth period.*

Occurrences	Average length of grain	Duration of growth period
16	6.6 mm.	152.6
221	7.5	161.6
324	8.4	164.9
182	9.3	169.6
55	10.3	173.3
6	11.2	179.8

A negative relation exists between the width of the grain and the duration of growth period, as is shown in Table V.

TABLE V — *Correlation of grain width and length of growth period.*

Occurrences	Average width of grain	Average duration of growth period
23	2.35 mm.	172.9 days
212	2.70	169.8
455	3.20	167.5
102	3.66	157.6
12	4.16	145.8
4	4.57	140.0

But since the amount of time required to attain maturity, if within the limits indicated above, does not have any marked influence on the yield of grain, the principal interest in this character is with regard to selecting a variety which is most adapted to the average rainfall conditions in the district in which it is to be cultivated.

Number of grains per panicle and length of growth period. — The larger the number of grains per panicle, the longer the growth period, as is shown in Table VI.

TABLE VI. — *Correlation of grains per panicle and duration of growth period.*

Occurrences	Average number of grains per panicle	Average duration of growth period
7	92.8	142.4 days
83	132.8	155.9
240	173.9	161.7
215	240.0	169.2
129	280.5	168.2
60	319.8	173.6
16	359.1	187.6

Length of culm and duration of growth period. — When the culm length is from 1 to 1.5 m. there is no correlation between this value and the duration of the growth period. On the other hand, beyond this limit, there is direct correlation; the longer the culms the more protracted is the growth period and *vice versa*. For 167 varieties having a culm length of 1.5 m., the mean growth period was 164.6 days, while 84 varieties with a culm length of 1.7 metres required 172.4 days. One hundred varieties with a mean culm length of 1.2 metres required 157.7 days to reach complete maturity.

TABLE VII. — *Correlation of length of culm and duration of growth period*

Occurrences	Average length of culm	Average duration of growth period
41	1 508 mm.	157.0 days
45	1 143	153.8
101	1 257	160.1
183	1 350	163.8
163	1 445	164.8
169	1 548	170.7
133	1 648	177.0
86	1 746	174.7
50	1 840	172.4
13	1 944	187.3
2	2 067	161.5

Length of culm and length of rachis. There is direct correlation between these two values as is shown by Table VIII.

TABLE VIII. — *Correlation of length of culm and length of rachis.*

Occurrences	Average length of culm	Average length of rachis
17	930 mm.	181 mm.
289	1 298	230
472	1 488	271
188	1 668	320
13	2 139	360

Length and diameter of culm. — As a rule, the longer the culm, the greater its diameter, as is seen in Table IX.

TABLE IX. — *Correlation of length and diameter of culm.*

Occurrences	Length of culm	Mean diameter
49	1 240 mm.	4.6 mm.
228	1 346	5.5
405	1 471	6.4
234	1 545	7.3
28	1 412	8.2
5	1 894	9.4

The number of nodes and the duration of the growth period. — While the length of the culms varies considerably according to the growth conditions prevailing, the number of nodes is quite constant for a given variety. Varieties which have many nodes tend to mature later than those with smaller number, as is shown by the data given in Table X.

A slight positive correlation exists between the length of the grain and that of the culm, and between the length of the rachis and the number of its ramifications, while there is a negative correlation between the number of nodes and the length of the internodes.

Although the writer has only examined the varieties of rice cultivated in the Philippines, the number of data collected, and the exactitude of the

TABLE X. — *Correlation of number of nodes and duration of growth period*

Occurrences	Average number of nodes per culm	Average duration of growth period
2	3.7	114.0 days
16	4.6	147.7
375	5.5	152.6
427	6.3	173.6
148	7.3	188.9
6	8.2	207.5

methods employed in the work, render his conclusions extremely interesting to those engaged in the selection and improvement of this important plant. In the best individuals, the development of the various organs shows average values, avoiding extremes such as great length or shortness of culm; too great precocity, or the reverse; these extremes being accompanied by low yield, as has already been observed in the case of malting barley and oats. However, after having eliminated the plants possessing characters correlated with a small grain yield, the plant breeder should, when isolating the most suitable types, give the preference to those of which the positive characters oscillate around the average value, rather than to those for exaggerated forms and characters which are nearly always associated with a deficiency in organic equilibrium, and consequently with a decrease in yield.

28 — Correlation between the External and Internal Morphology and the Length of Vegetative Period of some Varieties of *Trifolium pratense*; Researches in Russia. — Жолтевич В. Жолтевич В. J., in *Краткое Обозрение Аграрной науки* И. С. Коссовича, Review of Experimental Agricultural Science dedicated to the memory of P. S. Kossowitch, Vol. XVII, Part 3, pp. 239-248, Petrograd, 1917.

Researches carried out part at a farm in the province of Orel, part at the agricultural laboratory of the University of Kiev. The observations were made in 1912 and 1914.

In the first year, 5 clovers from different localities were tested: 1) Podolia clover; 2) Orel clover; 3) improved Orel or Stroukovsk; 4) *Trifolium pratense foliosum*; 5) Perm clover. These varieties all had a different flowering time, and from this point of view could be divided into two groups: 1) *early clovers*, including the first three varieties; 2) *late clovers*, including the two latter varieties.

In 1912, the Podolia clover began flowering on June 12, and the Orel and Stroukovsk 5 to 6 days later. The two late varieties, *T. pratense foliosum* and Perm clover only commenced flowering on July 1. Thus the difference in time of flowering between the early and late varieties is a maximum of about 3 weeks.

External and Internal Morphological Characters of the 5 varieties of clover

Varieties	Internal Morphological characters					External Morphological Characters														
	Year 1912					Year 1914					Year 1912					Year 1914				
	Diam- eter of cells of pollen- tary chyma	Length of the stomates in micro- scope field	Number of stoma- tes in micro- scope field	Number of detrital cells in micro- scope field	Diam- eter of the cells of pollen- tary chyma	Length of the stomates in micro- scope field	Number of stomates in micro- scope field	Average length of a stem	Number of leaves per stem	Number of nodes per stem	Number of inter- nodes per stem	Trien- nal clover	Biennial clover	Number of nodes per stem	Average super- ficial area of a leaf					
Podolia Clover	18.4 μ	19.7 μ	17.8	51	16.8 μ	19.7 μ	16.5	54.2 cm.	1.8	2.7	7.4	7.7	6.4	—	14.6 sq. cm.					
Orel Clover	—	19.7 μ	15.9	52	—	—	—	53.5 cm.	2.1	3.4	7.8	—	—	—	—					
Stronkovsk clover	—	18.9 μ	18.0	51	—	—	—	—	2.8	3.8	8.0	—	—	—	—					
<i>Trifolium pratense folium</i>	—	—	—	—	13.3 μ	18.6 μ	18.3	—	—	—	—	—	8.1	—	22.3 sq. cm.					
Perm Clover	16.9 μ	17.5 μ	22.9	71.2	—	—	—	60.1 cm.	3.3	4.7	9.5	8.8	—	—	—					

In the second year, two varieties were studied, *Podolia* clover and *Trifolium pratense foliosum*; they began flowering respectively on May 27 and June 14.

In all the above varieties, the following morphological characters were studied:

INTERNAL MORPHOLOGICAL CHARACTERS (on 30 leaves per variety):

Diameter of the cells of the palisade parenchyma (40 measurements per leaf).

Length of the stomata (20 measurements per leaf). Number of epidermal stomata visible in the field of the microscope (10 counts per leaf).

Number of epidermal cells visible in the field of the microscope (5 counts per leaf).

EXTERNAL MORPHOLOGICAL CHARACTERS (on 65 plants per variety):

Length of the stem.

Number of internodes per stem.

Number of branches per stem.

Number of inflorescences (heads) per stem.

Average area of a leaf.

All these characters are summarised in the table on page 67. As regards the *internal morphological characters*, the table shows that:

In the early varieties of clover, the length of the stomates and the diameter of the cells of the palisade parenchyma are greater than in the late varieties.

As the length of the stomates diminishes, so does their number increase per unit of area, as also do the number of epidermal cells.

As regards the *external morphological characters* it is seen that the late varieties have: a longer stem — more internodes — a more marked tendency to branch — a greater number of flower heads per stem.

Correlation between the number of internodes and the times of flowering.

— The author quotes from Russian work done on this subject:

With regard to the varieties of *Alectorolophus* (= *Rhinanthus*) *major*, N. V. ZINGHER (1) wrote: "These varieties, flowering at different periods, differ from one another not only biologically, but also morphologically. The relatively late flowering variety, suitable for cutting at the end of July, is distinguished from the spring-flowering variety cut in June by: double the number of internodes and a more marked tendency to branch." The same author writes, regarding 5 closely related varieties of this plant: "A close comparison of these different varieties at flowering leads to the conclusion that all the differences between their vegetative organs can be reduced to a difference between the number of internodes per stem and in the rapidity of development of the chief stem. A close relation has been established between the number of internodes and the length of development of the variety: the longer the development, the later is flowering and the larger the number of internodes of the principal stem; the rapidity of development of the stem is closely connected with the time required for development." On the other hand, V. N. KHITROVO, in his *Critical Notes* on

(1) Cf. Bulletin of the Tiflis Botanical Garden Vol. XII, Part 2.

the genus *Goum* and its hybrids in the province of Orel, says: "We are certain of the following facts:

"1) The number of internodes is sufficiently constant for each species.

"2) It is the most evident external sign of a given period of flowering.

"3) The number of internodes is also connected with certain other external characteristics of the stem.

"The selection of plants: 1) "of early flowering"; 2) "of late flowering", is the same as the selection of plants: 1) "of a limited type of structure"; 2) "of a numerous type of structure" with an exact agreement with the terms of comparison. In other words, within the limits of a series of related forms, a fixed unity of time, that is, the unit of the vegetative period, corresponds with the development of each structural unit of the plant in space". This author further writes: "we can thus indicate an external character useful for selecting in order to obtain a variety of a certain type of flowering" (1).

JOLTKEWITCH says that his researches show the existence of a correlation between the two classes of characters: structure of the stem and dimensions of the cells. He has also measured the length of the corolla tube in these varieties and has found that it is less in the late varieties than in the early ones.

In grouping the information on the internal morphology (see Table) according to the 3 most common colours of the corolla: red, pink, white, he found that in the Perm variety the non-red flowers form 10% of the total, while in all the other varieties, they form 50%; on the other hand, in the varieties with white flowers, the stomata are smaller than in the plants with red flowers.

1. ГАЙДЕРОВ Ф. А. (F. A. SAZYROV), in *Труды Института Биологии* (Trudy Instituta Botaniki), No. 12 (76), p. 231, Petrograd, December 1911, has published notes explaining the Russian translation of FRETWIRTH's work on the selection of agricultural plants. With regard to clover selection in Russia, he says: There are two forms of this clover in Russia: the Orel clover, grown chiefly in the provinces of Orel and Toula; Southern early clover, grown in south west Russia. These forms were studied for 3 years in the United States, and their position decided. The first form was described by BRAND as a new variety: *Trifolium pratense* var. *Brandi*. It is distinguished from the southern form by later flowering, taller growth and greater development of the vegetative organs, greater productivity, smaller and seedier seeds and is more lasting. These researches drew attention to the forms in Russia, and was found that, owing to not distinguishing these two forms, Orel clover has been replaced by the southern clover in the regions where it was originally more common (provinces of Orel, Toula and Livonia).

V. B. KURTOVO showed that lateness in the Orel clover is related to the "greater number of internodes of the flowering stem, and this is why he advises the use of this character as a guide to selection".

In addition, the Author mentions the selection work carried out by the Selection Stations in Moscow and Kharkov and by the Agricultural Experiment Station of Chastilovskaja (proximity of Toula).

(Ed.)

29 - **Experimental Work in Egypt on Various Cereals.** — I. DUDGEON G. C. and BOLLAND G., Work on Egyptian Wheats, in *Egyptian Ministry of Agriculture, Technical and Scientific Bulletin*, No. 7, 9, pp. Cairo, 1916. — II. HUGHES P., Tests of Flour made from Egyptian Wheats, *Idem.*, No. 10, 12, pp. illus. — III. BOLLAND B. G. C., Work on Great Millet (*Sorghum vul. ariz*) and Bersim (*Trifolium alexandrinum*) (1), *Idem.*, No. 8, 8, pp. — IV. DUDGEON G. C. and BOLLAND B. G. C., Work on Egyptian Maize, *Idem.*, No. IX, 8, pp.

I — *Work on Egyptian Wheats in 1915.* — Experiments on the amount of seed to sow, the yield of different varieties, and seed treatment for "smut". It was found that sowing at the usual rate of 6 "kelas" (2.72 bushels) per "feddan" (1.038 acres) gave the highest yield and that harrowing in the seed gave a better result than ploughing in. The four varieties tested for yield gave results (in order of merit) as follows :

1) Variety White Baladi . . .	yield	61.46 bushels per acre.
2) " Hindi	"	56.96 " " "
3) " Red Baladi	"	51.01 " " "
4) " Muzaffarnagar	"	56.54 " " "

Copper sulphate at strengths from 0.5 to 10 per cent strength and Cyllin at 1 in 100 to 1 in 250 strength were used to treat the seed for smut. The results indicate that the copper sulphate solution should not be used more concentrated than in 2 per cent solution, which gave the best result. The Cyllin and the copper sulphate, if used too strong, reduce the germinating capacity. The Cyllin solutions were all found to be too strong, though successful in preventing smut.

II. *Tests of Flour made from Egyptian Wheats* : Proceeding from the definition by HUMPHRIES and BIFFEN of strength "as the capacity of a flour to yield large well-piled loaves", it was endeavoured to ascertain the strength of the flour by measurement of the gas evolved on fermenting the flour with yeast. To avoid variations in the quality of the yeast, a number of tests were made simultaneously, the gas being measured by displacing water. Table I shows results obtained by this method.

It should be noticed that all the samples of Indian wheat examined gave a small volume of gas, and should, according to this test, be classed as "weak" wheats. *Saudi* wheat, again, appears to be "strong". During these experiments, it was found that uniformity of grinding was most essential; unevenly ground samples gave a much poorer yield of gas than when finely ground. Another set of tests in relation to manuring showed that potash and phosphatic manures gave most marked effects on the gas production. This bears out the result of the Experiments of the Royal Agricultural Society at Woburn, where it was found that mineral manures i. e. potash salts and phosphates, usually give a stronger wheat than that given by nitrogenous manures alone.

In any case, the gas tests require to be supplemented by actual trials of baking bread.

III. *Work on Millet (Sorghum vulgare) in 1915.* — An attempt to

(1) See No. 33 of this Bulletin.

(Ed.).

TABLE I.

Variety	Where ground	Molature per cent	Nitro- gen per cent	Bran per cent	Weight of 1000 seeds in gr.	Gas evolved from 20 gr flour, in cc.
from Egyptian seed	—	11.42	1.65	10.5	44.6	259
from Indian seed	—	10.46	1.52	9.8	42.7	260
<i>haladi</i>	—	11.04	1.48	8.9	46.3	365
te <i>haladi</i>	—	10.36	1.98	10.8	50.8	451
te	Assut	9.36	2.14	9.3	51.0	504
te	—	11.14	1.62	10.3	38.0	280
te <i>sa'idi</i>	—	10.02	1.60	10.6	45.2	520
te F. A. Q.	—	9.86	1.64	10.6	57.2	570
te	—	10.06	1.55	9.4	—	470
te	—	10.74	1.50	9.6	40.5	495
te Beni Suef, Basin		9.58	1.65	10.3	36.1	264
te Beni Suef, Canal		9.66	1.50	9.6	40.5	250
te Imported choice white		10.00	1.60	—	—	265

mate from among the common names given to millet in Egypt the separate varieties and to describe them; also to improve the yield and quality of the crop by selection and isolation of pure varieties. The different seeds were found to be so mixed that no accurate description was made, further, in different localities different names are given to the same variety.

Small samples of 24 distinct varieties of millet were obtained from Sudan and grown at Giza, but no comparisons of yield were made, the seeds being too small. The 24 varieties are described in tabular form, work is being continued.

IV. *Work on Egyptian Maize in 1915.* — The growth of maize (*Zea mays*) is well suited to Egypt and is gradually replacing millet over large areas. The varieties are all mixed and grown together so that selection breeding work has been started in order to improve the crop and to isolate pure varieties. The work is still in progress.

Wheat-land in the Republic of San Salvador, Central America. — *Centro America, Boletín de Publicidad de la Oficina Internacional Centro-Americana*, Vol. VIII, No. 3, pp. 439-440. Ciudad de Guatemala, July-September, 1916.

According to information collected by DR. A. HERNANDEZ, there are, in the Republic of San Salvador, 224 *caballerías* (about 10 000 hectares) of land planted to wheat growing and spread in nearly all the departments. Such area cultivated under modern methods, could produce 220 000 hectolitres of corn, or 130 000 quintals of flour, an amount larger than that imported.

The country has thus the possibility of supplying its own wants.

Besides, the presence of abandoned mills show that wheat was formerly grown.

In the department of Santa Ana, an area of 25 *caballerías* (125 hectares) is suitable for wheat-growing. The neighbourhood of the town of the same name is very fertile, and produces with little labour and no manuring, fine crops of beans, maize, wheat and other cereals.

In the cantons of Rosario (district of Metapan), San Miguel, El Brujo and San José, there are farms growing sugarcane and wheat at the same time or coffee, sugarcane and wheat, and which also have a flour-mill. In 1914 Apameca (department of Ahnachapán) produced 58 quintals of wheat. Ataco, the same amount; Jujutta, 69 quintals; Atquizaya, 11 quintals.

In the Sonsonate zone, where the mean annual temperature is from 20 to 22° C., wheat is grown on a large scale (by the side of the sugar cane, coffee, and maize). The cold and well wooded land in the north (oaks and pines) where the mean average temperature is about 16° C. produces very good wheat and other cereals. In the north of Yuayúa, there are several districts suited for wheat-growing. In the district round the capital, the zones of El Paisnal and Guazapa should be mentioned as wheat land.

The best and most extensive wheat land is to be found in the department of Chalatenango. Intensive wheat growing is carried on at San Ignacio, where not less than 60000 quintals of grain are produced annually. Wheat is regularly grown in the valley of San José del Sacare (near La Palma), in the neighbourhood of Los Planes and La Granadilla. All these cantons have mills. Other districts having excellent wheat land are: Citalá — La Reina — San Fernando — Dulce Nombre de María — San Francisco — Morazan — La Laguna — Carrizal — Ojos de Agua — Comalapa — Quezaltepeque — Estanzuelas — Perquicu — Yámabal — and also the departments of Tecapán, Morazan, etc.

The elevated region of the department of La Paz is well suited to the growth of wheat among other crops. Round Alegría and on the plain of Quemela, wheat succeeds extremely well, as the farmers have found by experimenting. The products for home consumption grown by the small growers in the district round Santiago also include wheat.

31 - The Cultivation of the "Broom Sorghum" in Tunis. — *Bulletin mensuel de l'Office du Gouvernement Tunisien*, Year 10, No. 91, pp. 70-71. Paris, September-October 1903.

In Tunis the cultivation of sorghum is not much developed; nevertheless the planters and natives of the rainy regions in the north of the Regency devote a certain area to its cultivation. White sorghum, which gives a very white and nourishing flour, is the most widely grown variety. The cultivation of Broom Sorghum (or red sorghum) has been tried at Tabarka, Nefzas, Hedills and Mateur. (Trials have also been made on several occasions in various parts of Algeria, especially in the Philippeville district). A workshop for making brooms has even been established at Mateur, in the hope of founding a Tunisian industry, but without obtaining the desired results. This idea has now been revived by the Economic Department of the Tunisian Government, which has just established a little broom manufactory.

The variety grown in Tunis that gives good products is the half-red room sorghum from Provence.

The seed is drilled on well, freshly cultivated ground from April 15 to May 15 at the latest, in lines about 2 ft. 6 ins. apart and with 1 ft. to 1 ft. 6 ins. between the plants. The yield per acre is 10 to 12 cwt. of straw and, theoretically, 24 cwt. of seed, but in practice much less is obtained because of the sparrows which take the grain and are most difficult to control.

In growing broom sorghum, as with the other sorghums, the grower is confronted with a degeneration of type which makes it necessary to renew the seed every year. This variation is attributed to crosses with the "bechua" and Alep sorghum.

France grows little broom sorghum, as it has only been known there for some sixty years; it is grown most in Vaucluse and a little in Bordaia, but even then it is most often grown round the edges of the fields.

The sorghum straw used in France comes almost exclusively from Italy. The principal importers are in Vaucluse, especially at Orange and Cadarousse. Broom manufacturers are found all over France, being, however, more numerous in the North than in the South. By having return cargoes, Tunis could supply the northern manufactures directly, as they buy supplies at Orange.

The straw is of two kinds, large and small. The small is much cheaper and is used to fill out the interior of the brooms. The large is used for the covering and fetched prices of recent years of from 10 to 16 s. per cwt.; at present it is worth 26 s.

Tunis could produce straw of finest quality able to bear comparison with the best Italian straw. Tunis even has the advantage of being able to dry the straw in the open air without a shed, as summer rains are usually very rare.

32- **Commercial Varieties of Lucerne in the United States.** — OAKLEY R. A. and WESTOVER H. L., in *United States Department of Agriculture, Farmer's Bulletin* 757, 24 pp., 7 fig. Washington, October, 12 1916.

At the present day 9 distinct commercial varieties of lucerne are recognised in the United States, varying in their adaptability to different climatic conditions. Some give the best results in the North and North West States, while others are only successful in the South and South West, where the winters are mild.

Under the term "common alfalfa" are included all lucernes which are not of quite distinct hybrid origin or which do not possess the characteristics of distinct and uniform varieties e. g. the "Peruvian" and "Arab" varieties. The "common alfalfa" group contains a large number of strains. They are often known by the name of the locality where they are cultivated, e. g. "Kansas grown alfalfa", "Montana grown alfalfa", and several others. Occasionally they are known by a term describing the conditions under which they are grown, e. g. "dry land alfalfa", "irrigated alfalfa", "unirrigated alfalfa" etc.

The strains from the Southern portion of the United States usually give higher yields than those from the North, but they are less hardy.

Hitherto, seed from "dry land alfalfa" tendered on the market has not shown any appreciable superiority over ordinary alfalfa in respect of resistance to drought.

A large number of experiments have been made throughout the United States with commercial lucerne from Turkestan. In almost every case it has proved inferior to the home product.

Definite determination has also been made of the adaptability of different varieties and strains of lucerne to varying conditions.

The principal commercial strains of "variegated alfalfa" are: "Grimm" — "Baltic" — "Canadian variegated" — "Sand Lucerne". With the exception of the last, they have been found more resistant to cold than the remaining commercial strains or varieties; they are consequently recommended for zones where winter frosts are frequent.

Peruvian alfalfa is unable to withstand severe winters and can only be successfully grown where the winter temperature is relatively mild, i.e. in the Southern and South Westerly States. Under favourable conditions the yield surpasses that of all other commercial varieties. Arab alfalfa is not a satisfactory variety as it tends to be short-lived.

The farmer should pay particular attention to the quality of the seed: thus, well-filled seeds, olive green in colour, are almost sure to germinate well whilst cracked or brown coloured seeds usually germinate with difficulty. It is also necessary to be on one's guard against inclusion of too high a proportion of weed seeds or other impurities.

In view of the fact that lucerne does not seed satisfactorily in a moist environment, it is practically useless to attempt cultivation for seed production in the Eastern States.

Selection of lucerne offers great possibilities, but involves so much time and expense that it cannot be undertaken by the farmer himself; this work should be left to the care of special institutions.

33. **Work on Great Millet (*Sorghum vulgare*) and Bersim (*Trifolium alexandrinum*) in Egypt** (1). BOLLAND B. G. C., in *Egyptian Ministry of Agriculture, Technical and Scientific Bulletin*, No. 5, pp. 8. Cairo, 1916.

Bersim is the term applied to four varieties of clover belonging to *Trifolium alexandrinum*, a plant apparently of Egyptian origin, and giving rich crops, which are taken in the winter and spring. Of the four varieties, *Ba'li*, *Fahl*, *Khadra'ci*, and *Misqā'ci*, *Fahl* is easily distinguishable by its taller, quicker and more luxuriant growth.

Misqā'ci and *Khadra'ci* have many common characteristics, and are better in growth than *Ba'li*, but are not up to the standard of the *Fahl* variety. The following table gives the measurements of the varieties.

If only one cut is desired, *Fahl* is the best variety to grow, as it gives no aftermath. The other varieties give fresh growth after being cut. A mixture of *Fahl* and *Misqā'ci* obviates the difficulty and gives a better yield than if *Misqā'ci* were sown alone.

(1) See B 1910, p. 63; B 1911, No. 812 and 1561.

(Ed.)

Variety	Height in cm.	Number of leaves per plant	Length of leaves in cm.	Breadth of leaves in cm.
Fahl	76.6	42	5.0	1.8
Maspia	44.5	23	4.8	1.9
Khadra	56.8	26	4.3	1.7
Ba'la	48.3	23	4.1	1.6

34. Sulla (*Hedysarum coronarium*) in the Agriculture of Southern Italy. —
 GIOVISO S., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 39, pp. 316-317,
 Piacenza, September 23, 1910.

While the other leguminous meadow plants, like vetches, crimson clover, lucerne, sainfoin, spread everywhere in the agriculture of southern Italy, sulla, the best of all forage plants for the clayey-calcareous soils of the south only appears occasionally, excepting those places where it grows naturally, in rare artificial meadows of this plant.

Natural meadows of sulla are common in the south, and much sulla hay is produced on fallow land, most often with little cultivation after a cereal crop. But, to retain this wild sulla, deep cultivation is avoided, thus causing injury both to cereals and forage.

This disadvantage was proved by the low yield of natural meadows of sulla in 1914 because of the drought, in 1915 because of the excessive rain. In 1916, the best natural meadows of sulla at Matera produced hardly 20 quintals of hay per hectare. On the other hand an artificial field laid down in 1912 on the property of the Faculty of Agriculture of Matera produced 50 quintals of hay per hectare in 1914 at one cut in May. In 1915, on another field laid down in 1914, sulla yielded 100 quintals of hay per acre; on another laid down in 1915, a crop of 60 quintals of hay was recently produced. A previous deep cultivation allows the strong root-system of the plant to penetrate deeper in the soil and thus resist lack of water.

Sulla hay as produced in the south, both from natural and artificial meadows, is very coarse, which is one of the principal popular objections that prevent its spread. On natural meadows, this is due to the habit of cutting late, after flowering and sometimes even when fructification is well advanced. For artificial meadows, it is due to this habit and to the rampant growth of the plant, as well as to the thickening of the stems cut only once in spring. But it should be noticed that natural sulla hay from the south, cut just at the beginning of flowering, is in no way inferior to good clover hay. By pasturing on the sulla in winter, or by what amounts to the same thing, cutting in winter a good cut may be had in May. This has been subjected to experiments which gave the following results:

		Yield in green sulla per hectare	
		with winter cut	without winter cut
First cut:	Jan. 15, 1916.	300 quintals	—
Second cut:	April 19, 1916.	280 "	440 quintals
Total		580 quintals	440 quintals

A sulla meadow cut twice produces not only more abundant spring pasturage and 30 % more than with a single cut, but it gives equally fine and succulent pasturage in January as well as in April. In addition the winter-cut sulla stooled considerably, so much so that the single cut sulla did not have more than 6 stems per plant, while the twice-cut sulla had up to as many as 24 stems.

It is not easy to obtain 580 quintals of forage per hectare in central and southern Italy without irrigation, neither with lucerne, sainfoin, nor with temporary grassland. Given that, in the southern and non-irrigated regions, intensive breeding will be more and more practised on the half-housing system, then the two-cut sulla will provide the requisite of a suitable winter pasture.

Sulla is unequalled on clayey-calcareous soils, and with suitable cultivation, does well in all other types of soil, according to SBRÖZZI, provided that the climate will allow it. The writer has visited excellent fields of sulla having been laid down on soil formed from the disintegration of tertiary conglomerate, which soils are very extensive in the south. The excessive winter humidity and the consequent lack of air in the soil render cultivation of the upper layers indispensable for draining the soil, without which the sulla may become weakly or even rot. The use of manure, since sulla has been grown in the south, was found to be very useful; it may even be considered as being among the best long-lived plants grown in the south as regards its utilisation of manure.

Bacterial inoculation of soils that have never grown sulla does not appear to be always necessary, as a good dressing of manure may often suffice. The specific bacterium may be present, or may be derived from the bacterium of another species of *Hedysarum*, a common wild plant in the south, and close to sulla: *Hedysarum spinosum*. In a gravelly southern soil of lateritic loess on Monte Scagnoso, sulla succeeded without inoculation only after 5 attempts, four years being failures. In cases like this, inoculation should certainly be given with soil on which sulla had been grown. After inoculating with 30 quintals of the soil per hectare, Dr. MAUREA was easily able to introduce the growth of sulla in Capitanata on the soils of ordinary quaternary terraces. The action of the inoculation was evident, as was shown by the places where the soil for inoculation (which came from the Abruzzi) had been unloaded. In order to commence growing sulla with better results, Dr. MAUREA always adds a few kg. of sulla per hectare to the seed of other forage plants (clover, vetch, lucerne, sainfoin). The husked seeds of the sulla are soaked in warm water, and then are sown at the beginning of October in the south of Italy; it is grown with oats, which are first

covered with a gang-plough or a weeder, then the sulla is covered more lightly.

Sulla thus sown on ground that has already grown the plant, normally gives a cut mixed with stubble soon after harvesting the oats. In the following year, 100 quintals of hay per hectare are often obtained. The year after, it yields, according to the weather, 60 quintals or more per hectare, after which the field is broken up. On the other hand, in hilly districts, spring sowing is more advisable, if it follows after winter cultivation, while if sown on winter cereals, it is liable to fail owing to lack of water at germination.

As has been remarked previously, sulla will have, according to the author, the merit of regenerating agriculture in the dry soils of the south of Italy.

35 - **Nettles as Forage Plants.** — GARCIA SANTOS, in *A Vinha posta uzea*, Year XXXI, No. 9, pp. 276-280. Lisbon, September 1916.

The writer advises the growth of nettles on ground that cannot be used for other crops, but which is not excessively dry, and in regions where forage is scarce. Nettles are very resistant to extreme temperatures, whether high or low, and have been long grown for forage in Sweden. Several writers have advised its growth in France, as its qualities have not been properly realised up to the present. It is sown in lines of 12 to 16 cm. apart in August or September; 10 kg of seed per hectare are used mixed with sand to obtain a uniform distribution; the seed is harrowed in. No cultivation is needed and manure should be given every three years. 3 cuts a year can be made before the stems begin to harden. The cut plants are left lying on the ground for some hours. When the plants wither, the stinging hairs lose their liquid contents and become harmless. Before giving this forage to animals it should be beaten or well shaken. An analysis of green nettles gave: 12.8 % of protein — 4.9 % of fatty matter — 30 % of carbohydrates. The composition is therefore similar to that of the best meadow hay. This forage is suitable: for dairy cows, in amounts not exceeding one-quarter of the weight of the ration; it seems to produce a more butyrous milk and butter of better quality and colour — for pigs, mixed with offals and potatoes — for poultry, finely powdered and mixed with offals, potatoes or flour; it promotes egg-production. When using nettle hay, it should be wetted with warm water or salted, and the infusion thus obtained given to the animals, who drink it readily.

36 - **The Introduction of the Cultivation of the Coffee-tree into Reunion.** — DE VILLE AUGUSTE, in *Revue agricole de l'île de la Réunion*, 11th. Series, Year 4, No. 6, pp. 215-233. Saint-Denis, Reunion, June 1916.

The first attempt to introduce the cultivation of the coffee-tree into Bourbon island, or Reunion, dates back to 1712, when the Lords of Saint-Malo obtained from the king of Yemen the permission to take coffee plants from Moka to plant in their island. This task was entrusted to LAGREDOLIERE, but the plant obtained died during the journey. Another attempt, made in 1715, also failed. Finally some cargoes of coffee were sent to Re-

union (two in 1719), and were found to contain whole fruits; this resulted in the planters becoming aware that a plant growing in the woods of the island and producing similar fruits was probably a native coffee-tree. The fruits were gathered and prepared in the way reported to be usual in Yemen and it was found that the island had a wild native coffee-tree; soon after, the first cargo was sent to France. The plant was only studied botanically at a much later date, using a plant coming from the Isle of France and named *Coffea mauritiana*.

In 1717, M. BEAUVOLIER DE COURCHANT, governor of Reunion, obtained several coffee plants during a visit to Moka, but all died on the voyage save one which was given to the care of BOUCHER DESFORGES, then the king's lieutenant at St. Paul. This plant grew well, produced fruit and was quickly propagated. From 1727 to 1731 this colony produced 1 286 000 lbs. of coffee bought by the India Company at 4 d. to 5 d. per lb. During the years following the introduction of the coffee tree, the island was several times devastated by cyclones; the growth of coffee further suffered because the India Company refused to buy more than 1 million pounds of the coffee produced by the island, which was then (1743) producing 300 million pounds. At this time the establishment of new coffee plantations was forbidden under pain of a fine of 200 *piastres*, and a Commission was appointed to destroy all new plants and 4 times as many of the old ones.

The reputation of Reunion Coffee was now made; the town of Basora, which up to that time used to buy supplies from Moka, asked for 300 bales of Bourbon Coffee from the India Company. In 1757 DE FLOTTE wrote after visiting the island: "here one sees fine plantations of coffee reputed to be the next best after that of Moka".

In 1767, GRESLE introduced the "black wood" from India (*Albizia Lebbek*), for shading the coffee-tree. The plant soon spread through the plantations, but was unfortunately killed by disease in several localities, and its death caused that of the coffee tree as the dead roots poisoned the soil. Then came attacks of insect pests such as *Elachista coffeella* and *Lecanium coffeae* (the latter has wrongly been stated to be of recent introduction). In 1820, the advisory council of the island, thinking that the coffee-tree was degenerating, asked the French Government to send new seed. PROF. PAUL THOUIN, being consulted, advised grafting the Moka coffee tree on the species cultivated in the colony.

Other coffee-trees of different origin from that introduced by BEAUVOLIER DE COURCHANT, but not defined, had been introduced; such as myrtle or Eden Coffee, the extremity of whose leaf, not such a deep green as that of Arab coffee, was then of reddish colour, and the Lervy coffee which, according to BILLIARD and DR. VINSON, has been imported from Africa, but, from certain information obtained by the writer, has resulted by mutation from the Arab coffee-tree, which is called "local coffee-tree" (1).

(1) In Reunion there are 2 varieties of *Coffea arabica*: one with round or oval seed, called "local coffee" in the colony, and on the European markets, "round Bourbon", the other

In 1823, the Governor of Reunion sent NICOLAS BRÉON, director of the "Jardin du Roi" of the Colony, on a mission to Arabia to bring new coffee seed. BRÉON brought, as well as seeds of *Cordia alliodora*, the tree used in Moka and Bet-el-Fangui to shade the coffee-tree. (The possibility of the introduction of *Lecanium viride*, *L. nigrum* and *L. coffea* with these importations must be excluded, judging from the precautions taken). Nevertheless the introduction of new seed in no way modified the situation of coffee growing, gravely menaced by the competition of the sugar-cane, and the impoverishment of the soil, which received no manure other than that of the leaves fallen from the shade trees.

In 1878 M. JULES POTIER, director of the Bourbon Colonial Garden, while visiting the Maurice Island Exhibition, brought coffee leaves infected with a fungus from Pamplemousse to the Colonial Garden in order to examine the parasite which he identified as *Hemileia vastatrix*. The parasite infected the Colonial Garden, and soon spread through the island, diminishing the production of coffee from 534 720 kg. in 1878 (from 3 895 hectares) to barely 190 000 kg. in 1883 (from 5 682 hectares).

In 1879, new seed was bought from London and Ceylon: seedling in the Colonial Garden produced 900 young plants, sold in 1880 to various growers; at the latter time, 60 000 seeds of *Coffea liberica* were introduced from Ceylon. Through M. EMILE CHRIST seeds of the following plants were introduced: *Coffea excelsa*, *C. robusta*, *C. canephora*, *C. congensis*, *C. koniloniensis*, *C. maragopife*.

17. The Influence of Different Treatments of Beet "Seed" on the Beets resulting after Sowing. — FALLADA O. and GREISENBÜCKER J. K. in *Oesterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, 45th Year, Part 4, pp. 330-347, Vienna, 1916.

The question of a suitable treatment for the "seed" of beets in order to assist growth and consequently increase the yield of roots or sugar has been the subject of many researches. Thus, GUNTHER proposed the decortication of the false fruits before sowing, TENSEN advised soaking them in water till swollen, and HILTNER has advocated maceration in concentrated sulphuric acid.

Because of the divergent results of these treatments, new experiments are repeated with the exception of the decortication of the false fruit, a proceeding considered by the majority of experts as positively harmful.

The false fruits (commercial "seed") of the beet variety "Dobrowitz normal" were divided into 4 lots treated in the following manner:

Lot I. — Soaking in cold distilled water till swollen for 12 hours just before sowing.

Lot II. — Maceration on the HILTNER method: the false fruits were gradually mixed with $\frac{1}{4}$ of their weight of concentrated sulphuric acid,

the treated berries, called "Leroy coffee" on the island and, in the trade, "pointed Bourbon".

"Rouge Bourbon", because of its exquisite aroma, has always been the variety most demanded. Cf. E. DE WILDEMAN, *Les plantes tropicales de grande culture*, Vol. I, p. 99, Arles, Castaigne, 1908. (Ed.).

stirring constantly for 2 hours, then sprinkled with quicklime and afterwards washed three times.

Lot III. — Soaking in a 0.25 % solution of "Uspulun" for 4 hours before sowing.

Lot IV. — Control.

Sowing was carried out in the spring of 1915 on 12 different plots that had received, per acre: 14 tons. of farmyard manure before winter; in early spring 56.2 lbs. of water-soluble phosphoric acid (superphosphate); 79 lbs. potash (potash salts); and 47.7 lbs of nitrogen (nitrate of soda).

The total area of the 12 plots amounted to about 50 sq. yds. so that each of the lots comprised 3 plots each of a little over 4 sq. yds.

Sowing took place on April 24, the leaves appeared between May 1 to 8 and the crop was gathered 208 days after sowing — November 17. At first, no great differences of growth were observable between the various plots. Nevertheless it was seen that, in spite of sowing the same quantity of "seeds" the plots sown with macerated seeds showed a smaller number of individual plants, but closer examination showed that these same plants were of more vigorous growth from the start.

The seeds macerated in sulphuric acid appeared the first with a gain of 6 days over the control plot, and of 2 or 3 days over the seeds swelled in water or in "Uspulun" solution (1). The appended table gives the results of the experiments, the results being very satisfactory, including those of the control plot. The treatment of the seed was shown to be worth while; maceration in sulphuric acid gave the best results, though the process is not quite free from objection.

Experimental Results.

Treatment of the Fruits	Number of beets	Results of the crop				Results of tests					
		Total crop		For 1 beet		Proportion of leaves for 100 of root	Sugar		Composition of the juice		Quotient of purity
		in lbs.		in grms.			Con- tent	Degrees Balling	Sugar content		
		Roots	Leaves	Roots	Leaves						
Control.	42	59.34	27.43	549 g	301 g	54.7%	19.65 %	23.37	21.36 %	91.4	107.2
Swelling in water	43	53.61	27.43	567	290	51.2	19.33	23.13	20.80	90.3	106.1
Maceration in sulphuric acid.	39	56.54	28.49	639	359	51.6	19.13	23.12	20.80	89.9	112.4
Soaking in "Us- pulun"	44	56.54	28.16	589	293	49.9	19.30	21.76	20.82	91.4	113.3

(1) See No. 100 of this Bulletin.

(Ed.)

38 - **The Influence of the Lime: Magnesia Ratio in the Soil on the Yield in Seed of Sugar-beets.** — FALLADA O. and GRESENZHOGER I. K., in *Oesterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, 45th. Year, Part 3, p. 117-122, Vienna 1916.

Experiments to determine the influence of manurial treatment with magnesia on the yield in seed of sugar-beets. The experiments were carried out in pots, divided into 3 groups and containing soil very poor in lime and magnesia and made up of 94 % of tertiary quartz sand and 6 % of washed and then dried super-aquatic turf. In Group I, the lime and magnesia were added in the ratio of 1 : 3; in Group II in the ratio 1 : 1; in Group III in the ratio 3 : 1.

In the pots flowering beets of equal size were planted. The necessary water was given by watering with the KNOP nutritive solution. The calcium and magnesium were given in the form of finely powdered hydrated sulphate. The plants developed normally in spite of individual differences in the development of the aerial parts. The crop was gathered in the following manner: stems and leaves were cut off close to the beet and preserved; after 4 weeks the inflorescences were separated from the stalks and the seeds were then detached from their envelopes and weighed. The weights of envelopes and stems were also ascertained. These weights, combined to form a table, show that the results differ according to the individual plants. In Group I the yields in inflorescences varied by more than 100 %. The weight of the stems varies somewhat less than that of the inflorescences. The weight of these latter increased on the average parallel with the increase of the proportion of lime. In Group I, the weight of the stems is 3.5 times as great as that of the inflorescences; in Group II, the preponderance of the former decreased notably; in Group III, the inflorescences represent almost half the weight of stems and leaves together. With the ratio lime : magnesia equal to 1 : 3, the inflorescences form 22 % of the total yield; with the ratio 1 : 1 they form 26 %; and with the ratio 3 : 1, it increases to 35 %. Thus the increase in the amount of lime given resulted in a noteworthy increase of the weight of the inflorescences, which is of great importance for the selector and breeder of seed.

The water consumption of the various groups was also determined and compared with the production. It was found that the absolute quantity of water required was practically the same for all the groups. The increase of the lime content of the soil so as to equal that of magnesia resulted in a 7 % decrease in the water consumed in relation to the aerial parts. Nevertheless, the most important result was that, given equality of the absolute water consumption, the pots with a lime magnesia ratio of 3 : 1 produced almost twice the amount of inflorescences than those pots having the ratio 1 : 3. If, on purely sandy soil, the economy of water is shown so distinctly, a great economy still may be expected in heavy soils, where the focculating action of lime can be seen more clearly and cause an increase in the production of the inflorescences — a sign of better utilisation of the reserve moisture.

If the lime factor does not seem to have, in itself, much importance

for the development of seed-producing beets, yet the lime-magnesia ratio of the soil is of considerable importance for the formation of the inflorescences.

A predominance in ratio of magnesia in the soil is unfavourable for the production of inflorescences. With a lime-magnesia ratio of 3:1, the yield in inflorescences is almost double of that obtained with the ratio 1:3.

The increase of the lime content of the soil decreases the relative consumption of water. The factor "lime" and the ratio lime: magnesia deserve the attention of those growing beet seeds.

39 - The Peanut (*Arachis hypogaea*) and its Products. — THOMPSON H. C. and BAILEY H. S., in *United States Department of Agriculture, Farmer's Bulletin* 751, 16 pp. Washington, D. C., August 4, 1916.

Peanut oil is one of the most important of the world's food oils. In 1912, over 120 000 metric tons of peanuts in the shell, and about 240 000 metric tons of shelled nuts were crushed at Marseilles; about 15 500 000 gallons of edible oil and about 23 000 000 of inedible were thus obtained. In the same year, Germany imported 68 765 tons of peanuts, practically all of which were used for making oil. The imports of peanut oil entered for consumption in the United States for the year ended June 30, 1914 amounted to 1 332 108 gallons valued at \$ 915 930. Almost exactly half of this oil was imported through the port of Chicago, which would indicate that a large portion of it was used in the manufacture of oleomargarine.

There are at least 10 geographically different varieties of peanuts quoted on the Marseilles market. Those from the French colonies of West Africa (Gamba, Rufisque, Kasmanze, Rio Nuez and Bissagos) are usually imported in the shells, while the shelled nuts come from China, Mozambique, Bombay and the Coromandel coast of India. Peanuts in the shell from Rufisque, Soloum, Sina and Gambia contain from 35 to 36 per cent. of oil, and yield on a large scale from 28 to 30 per cent. of shells and 31.5 to 32.5 per cent. of oil, which correspond to 44 or 45 per cent. of shelled nuts.

The cake usually retains from 8 to 9 per cent. of oil. Kasamanze peanuts yield from 30.5 to 31.5 per cent. of oil. The decorticated nuts from Bombay and Coromandel yield 36 to 38 per cent, while those from Mozambique yield from 40 to 42 per cent. The best grade oils are made from stock shipped in their shells, as with these there is less opportunity for spoilage during the voyage. Chinese peanuts are however, an exception to this rule, for they are shelled almost entirely by hand, and carefully protected from water, or crushing. On the other hand, peanuts from the Coromandel coast are largely shelled by wetting them down with water, so that they open of their own accord: they can only be worked up for soap stock.

In the southern States of North America, especially in the districts infested with *Anthonomus grandis* the cultivation of the peanut has made rapid progress. On the other hand until 1915, very little peanut oil was manufactured in the United States. The problem now presents itself under two forms: how to use the excess production of peanuts, and decrease the large importation of peanut oil.

There are 5 distinct varieties of peanuts grown in the United States:

— "Spanish" — "Virginia Bunch" — "Virginia Runner" — "Valencia" (or "Tennessee Red") and "African" (or "North Carolina"),

Any of these could be used for the extraction of oil, but the "Spanish" variety is the best, and is the only one that should be grown for this purpose. In a shelling test of farmers' stock made by the United States Department of Agriculture, "Spanish" peanuts shelled out at 78.70 per cent, the "Virginia Bunch" 71.15 and the "African" 71.45 per cent (the weight of the unshelled nuts being taken as 100). In this test, the peanuts were shelled by hand; in a commercial shelling plant, at least, 10 per cent less nuts could have been obtained.

The writers give the analyses of 12 commercial samples of "Spanish" and of 19 of "Virginia" peanuts (these 2 varieties being most grown). The averages of the 2 series of analyses are given in Table I.

TABLE I. — *Analysis of peanuts of the "Spanish" and "Virginia" Varieties, as grown in the United States.*

	Moisture	Oil	Oil (dry basis)	Ash
"Spanish"	3.9 %	50.0 %	52.5 %	2.4 %
"Virginia"	4.1 %	41.7 %	43.3 %	2.7 %

It will be noticed that there is a difference in the amount of oil of about 10 per cent in favour of the "Spanish" variety. On the other hand, there is very little difference between the oil content of the 5 varieties cultivated under the same conditions. This is shown by Table II.

TABLE II. — *Analyses of 5 Varieties of Peanuts Grown at Florence (South Carolina).*

Varieties	Constituents of shelled nuts					Constituents of shells				
	Moisture	Oil	Crude fibre	Protein	Ash	Moisture	Oil	Crude fibre	Protein	Ash
Virginia Runner	3.35 %	46.58 %	2.73 %	29.60 %	2.26 %	5.23 %	0.73 %	78.28 %	5.07 %	4.11 %
Virginia Bunch	3.28	45.73	2.84	29.52	3.11	5.23	3.53	70.00	7.25	3.95
Spanish	3.30	49.10	2.30	31.20	2.67	5.03	3.20	66.70	8.16	6.81
Valencia	3.73	49.60	2.13	33.04	2.67	5.80	1.38	70.72	7.23	5.34
African	3.45	45.90	2.26	30.30	3.31	5.45	2.46	71.70	7.60	5.38

In order to make a very high grade edible oil, the peanuts should be thoroughly cleaned, shelled, blanched and degermed before being ground (between mills and rollers) and pressed. Experiments made in cottonseed-oil mills in the United States show that the presses now in use can be used for making peanut oil. The first pressing should be made cold, in order to get a high grade edible oil, the second should be made after regrounding and heating the cake from the first pressing. It is doubtful whether more than 2 pressings should be made in the United States. The oil from the second

pressing might be refined and used for cooking, or for the manufacture of oleomargarine, or it might be used without refining for soap making.

The principal by-product of pea oil manufacture is the meal. One ton of shelled "Spanish" peanuts will yield about 750 lb. of meal. This meal sells for \$ 30 to \$ 35 per ton and is an excellent cattle feed. Peanut meal has about the same value as a fertiliser as cotton seed meal, but its greater value is for live-stock feeding.

The peanut hulls are also a by-product. They can be ground with the meal to give it bulk, but they add very little to the food value. They can also be used as fuel in the oil factory, or sold as litter.

The average cost of production of peanuts in the United States is \$ 20 to \$ 25 for a yield of 35 bushels per acre. At 70 cents a bushel for the peanuts, and \$ 12 a ton for the hay, the gross returns would be \$ 32.50. At 70 cents a bushel for Spanish peanuts, the oil must sell for 60 to 65 cents per gallon in order to make a profit, calculated on the basis of 80 gallons of oil per ton of peanuts.

40 - On the Acclimatisation in France of a Quickly-growing Plant (*Rumex hymenosepalum*) containing Tannin. — PIEDALUE ANDRÉ, in *Comptes Rendus de l'Académie des Sciences*, 1916, Second Half-year, Vol. 163, No. 20, pp. 575-576. Paris, November 13, 1916.

One of the causes of widespread deforestation is the manufacture of tanning material from oaks and chestnuts, plants of slow growth. To stop the works, while preserving the forests from destruction, tannin-bearing plants of rapid growth must be sought. While several *Polygonaceae* contain tannin, *Rumex hymenosepalum* Torr. ("Canaigre") is amongst the richest as its tubers contain up to 28 or 30% per cent of tannin. It can be successfully grown in Corsica and in southern France up to the Loire. It was supposed that this plant could not be grown in northern France, but experiments at Sèvres (Seine-et-Oise) continued for 3 years, showed that it can be grown all over France, since the plant was not injured during the winter of 1913-1914 by temperatures of -12°C . These experiments showed that

- 1) *R. hymenosepalum* grows naturally in the climate of Paris.
- 2) The vegetation retarded in autumn grows well in spring.
- 3) The plant resists winter cold well.
- 4) In a well cultivated and manured soil, the plant gives a useful yield, even in unfavourable localities with insufficient light and abundant parasites.

It is proposed to conduct field experiments in order to study the yield of the plant under practical conditions and also its yield of tannin in the climate of Paris.

41 - The Effect of Continued Capillary Watering. — DANIEL LUCIEN, in *Comptes Rendus des Séances de l'Académie des Sciences*, 1916, Second Half-year, Vol. 163, No. 19, pp. 527-528. Paris, November 6, 1916.

The Author has studied, in his garden at Erquy (France), the effect of continued capillary watering compared with the intermittent watering employed in market-gardening. For this purpose vessels with a large surface

ace were used filled with water in which were dipped strands of wool or cotton which acted as syphons. The water thus supplied to each plant was easily calculated, as well as being easily reduced or increased by altering the number of threads. This method of watering had for advantages: economy of water — no burning of the leaves, even if carried on in open sunlight. — freedom from washing out of nutritive substances from the soil. — loosening of the surface maintained to the highest degree.

3 series of experiments were started: in the first, lettuce, chicory, and cabbage were left almost entirely without watering; in the second they received an abundant intermittent watering interrupted every 2 days; in the third they received capillary watering, which may be called continuous and in which the water was delivered at the foot of each plant by syphons of variable number.

The plants watered at too long intervals gave the worst results: the lettuce and chicory flowered. Those having intermittent watering, with larger amounts of water than those given by capillary watering, at first grew normally, but in the long run their leaves became red and hard or of an unequal green colour. Those plants having capillary watering always had turgescient leaves of a fine green colour and showing perfect health. None of the foot watered plants flowered, which also happened for a fair number of specimens in the second series, although in less number than in the first.

The same system was tried for germinating seeds and afterwards watering the seedlings. 300 lettuce seeds, 300 headed cabbage seeds, and 300 radish seeds were used. The seeds were sown under similar conditions, divided into three lots and watered as in the previous experiments. The results obtained were:

	Number germinated		
	1st lot: almost without watering	2nd lot: intermittent watering	3rd lot: continual watering
Batavia Lettuce	30	61	97
Cabbage	57	68	82
Radishes	43	57	80

It was found that continual capillary watering also gave plants much in advance of those of the other lots.

Anatomical study of the leaves, stems and roots has shown the differences that usually exist between plants suffering from drought and those with a normal supply of water.

With guaiacum stain, differences in the colouring of the latex of chicory were shown: the rapidity of the reaction and the intensity of the colouring were in proportion to good utilisation of the water. As the diastatic ferment did not act in the same way, it was explained by assuming differences in rhythmical development and in the nature of the products.

These experiments are of interest to both theoretical and practical

horticulturists. The author thinks that it will be easy to provide cheap and simple appliances, using capillarity, in order to provide cultivated plants with the water that they require in any given soil.

42 - Varieties of Chicory in the Province of Lecce, Italy. — MANNARINI ALBINO, in *Bollettino della Società orticola Varesina*, Year 4, N. 41, pp. 7-10, 8 fig. Varese, November 1910.

In the kitchen-gardens of the region of Lecce, 3 varieties of the type *Cichorium Intybus* are known and called "cicoria Catalogna", "cicoria di Brindisi or brindisina" and "cicoria all'acqua". Their origin is unknown but it seems that they have originated from selection and fixation carried out by the market gardeners of the region of Lecce. They are purely local and are much grown from Cape Leuca up to above Taranto, and much less in the province of Bari. In the rest of Italy they are hardly known save in the gardens of Naples and Rome, where they have been grown on a small scale for some years, the seeds being now and then imported from the region of Lecce.

A firm in Upper Italy sells the seeds of all three varieties under the general name of *Cichorium Intybus asparagoides*, for the shape of the stem is somewhat similar to the young shoots of asparagus. These three horticultural specialities do not require bleaching or any special preparation, while yielding an abundance of fine, hygienic and saleable product, that is preferred by those suffering from intestinal troubles.

"Cicoria Catalogna" (Catalonian chicory) has been known for a long time in the province of Lecce, as it was always, as it is now, the most grown of the three varieties. Like the other two, it has a much reduced root which is compensated for by the development of the stem which is hollow inside, conical in shape and clearly fasciated. The stem, which is the valuable part, is 40 cm long and 3 to 6 cm diameter at the base; it is tender, fleshy, with buds giving rise to little secondary stems also very tender; it is gathered by cutting at about 2 cm away from the crown of leaves. The plants form smaller and smaller shoots which provide the following crops. Among the three varieties, the Catalonian is nearest to the wild chicory for the slight pubescence covering the leaves and stem, the slightly bitter taste, the carmine colour predominating in the various parts of the plant, and the appearance of the leaves. The latter are usually pinnatifid, but they vary greatly, up to losing almost completely the divisions of the pinnatifid shape and to taking on an intermediate shape between linear and slightly lanceolate having slight crenations at the edges. The market gardener explains this by the presence of lettuce (*Lactuca sativa*) and prickly lettuce (*Lactuca Scariola*) in flower and which pollinates the "Catalogna". In addition, the gardener does not use plants for reproduction that have lost the clearly pinnatifid shape.

"Catalogna" chicory is grown in spring; it is planted as a seedling, then it is transplanted so as to remain at 35 to 40 cm distance apart in a square.

Gathering may be commenced at the end of March or at the beginning of April; there are distinct sub-varieties with varying degrees of earliness.

special care is necessary to prevent the loss of the seed which is very light and small, and also to avoid pollination by related plants. There are 1300 seeds on the average in one gramme, while 300 to 400 plants are necessary to produce 1 kg. of seed.

The "cicoria brindisina" is further than the "catalogna" variety from the type plant, as is shown by the almost total absence of tap-root, the much reduced leaf, the almost total loss of the pubescence of the stem and leaves, the great attenuation of the rather bitter flavour, etc. It is a very good vegetable that can be grown throughout winter. It is planted in every month of autumn and winter, then it is replanted in squares of about 30 cm apart. It is gathered during winter and spring; seeding is more difficult than with the other two varieties as it is very susceptible to frosts at flowering time.

The "cicoria all'acqua" (water chicory) has practically the same botanical characters as the "catalogna" variety from which it only differs by its smaller stem, which only grows to 20 cm high and 2 cm diameter at the base. It is gathered in summer, being practically the only market-garden product to be found on the market during summer in that hot and arid region. As the plant requires a plentiful water supply, its growth is limited to swampy land in the regions of Otranto and Ostuni, or in those places where well water is brought to the surface. This plant deserves to be grown more extensively.

- 13 - **Studies of Apples in Oregon, United States.** — I. WHITEHOUSE, W. E., A Study of Variation in Apples During the Growing Season, in *Oregon Agricultural College, Experiment Station, Bulletin No. 134*, 14 pp., Corvallis, Oregon, June 1916. — II. KRAUS E. J., Variation of Internal Structure of Apple Varieties, *Ibid.*, *Station Bulletin No. 135*, 42 pp., 31 plates, June 1916. — III. KRAUS E. J. and RALSTON G. S., The Pollination of the Pomoaceous Fruits, III; Gross Vascular Anatomy of the Apple, *Ibid.*, *Station Bulletin No. 138*, 12 pp., 7 plates, May 1916.

I. *Variations in Apples During the Growing Season.* — The object of these investigations was to determine whether there are more or less definite periods when apples under Oregon conditions make their main increase in bulk, and other periods when their characteristics colour markings developed, or whether increase in size and colour are both quite uniform throughout the growing period.

The method employed to determine the size and form of the fruit was to record the largest transverse and longitudinal diameters of each individual fruit every two weeks throughout the growing season, beginning near 25th. These measurements were made with Vernier's callipers reading to $\frac{1}{10}$ of a millimeter. The shape of each apple was ascertained by means of the "form index" which is obtained by dividing its transverse by its longitudinal diameter. At intervals, average fruits were taken from each of the trees under observation, weighed and the curves plotted; the increase in weight was then compared with the increase in size. In order to determine the amount of colour, the percentage of the surface of the fruit covered by its overlying colour was estimated every 2 weeks.

Records were kept of: the temperature — rainfall — and the approx

imate amount and intensity of the sunshine throughout the growing period, that it might be possible to correlate with the weather conditions any marked variation in rate of growth, or colour development.

The results thus obtained suggest several points of interest to the fruit grower. These are as follows:

If steady, gradual increase in size is normal for the apple, cultural conditions should be such that this steady growth will not be checked. In particular it would seem that tillage should be such as to provide a constant supply of moisture. Where irrigation is practised, it would seem unsafe to allow apples to become checked, depending upon later applications of water to force along the fruit and make up for deficiencies earlier in the season. Such practice might result in a specially rapid growth period, but the evidence indicates that this would be abnormal, rather than normal, if it occurred.

Often in thinning apples it is found convenient to remove the largest individual, or individuals, from the spur because of length of stem or some peculiarity of position. This investigation would lead to the belief that such is not good practice. The rank of an individual among its fellows at the time of thinning is a fairly accurate index to its probable rank at maturity. If experience shows that apples of a particular shape pack more easily in the type of package used, or take better in the market, than those of a different shape, a little bias in that direction can be gained by removing the undesirable shapes at the time of thinning.

A large part of the colouring matter of apples is deposited shortly before picking time. From the viewpoint of securing higher colour, it would seem that picking could often be delayed several days to advantage.

II. — *Variation of Internal Structure of Apple varieties.* — The data presented consist of 31 plates showing photographs made from transverse sections of apples (plates 1 to 20) and from transverse and longitudinal sections of pears (plate 31). The method adopted to prepare this material for being photographed, that is to say to render it perfectly transparent and show the detailed vascular structure, consisted in placing sections (of about $\frac{1}{16}$ to $\frac{1}{8}$ inches in thickness, and cut from the middle of the fruit) into 70 per cent alcohol. In this they remained for at least 24 hours, when they were passed through successive baths of absolute alcohol until they were completely dehydrated. The sections were then pressed lightly in filter paper, but not allowed to become dry; they were cleared first in cedar oil, and subsequently in a mixture of xylol and cedar oil.

III. *The Pollination of Pomaceous Fruits.* — The Division of Horticulture of the Experiment Station of the Oregon Agricultural College, at Corvallis, has commenced a series of studies of the pollination of pomaceous fruits. The first contribution to the question (E. J. Kraus, "Gross Morphology of the Apple," in *Oregon Agricultural College Division of Horticulture, Bulletin* No 1), was published in April 1913; a second ("Fruit Bud Development of the Apple") in *Station Bulletin* No 129, was published in May 1915; a third (E. J. Kraus and G. S. Raiston, "Gross Vascular Anato-

During the progress of the pollination studies, it became evident that various subsidiary factors, which may be more or less intimately connected with the pollination and development of the fruit had not been sufficiently investigated. One of the most important of these factors is the relationship that the vascular system of the fruit bears to its development. The writers devoted themselves to this study and, in the paper here summarised, they describe the vascular system of the normal fruit from its origin in the cluster-base, through the pedicel and fleshy portion of the fruit, noting the position, divisions, connections and terminations of the vascular system in the fruit. The "Yellow Newton" was the apple selected for investigation.

4 - Varieties of Cider Apple Suitable for the Manufacture of Jelly, in France. — TRUELLE A., in *La Vie agricole et rurale*, 6th. Year, No. 46, pp. 357-361, 2 figs., 1 pl. Paris, November 11, 1916.

From previous researches, and in particular those of MR. BARKER (Long Ashton, England), on various varieties of apples with sweet, acid, or bitter taste, it is concluded that the two last categories have an important defect from the organoleptic point of view for the manufacture of jellies; the necessary concentration of their juice leaves a disagreeable taste in the finished jelly, due to excess acidity in the one category, and to excess of bitterness in the other. While these defects can be remedied to a certain extent by mixing with the juice of sweet or slightly bitter apples in suitable proportions, it is evident that it would be better to use these two kinds of apple at once, as it would avoid the long and awkward operation of mixing, always difficult in practice. The Author, following BARKER's classification, arranges the varieties in the 3 following classes:

1st. Class: acid varieties: juice usually containing more than 0.45 grm. of malic acid per 100 cc.

2nd. Class: sweet varieties: juice usually containing less than 0.45 grm. of malic acid and less than 0.20 grm. of tannin per 100 cc.

3rd. Class: bitter-sweet varieties: juice usually containing less than 0.45 grm. of malic acid and more than 0.20 grm. of tannin per 100 cc.

The appended table gives the classification of 50 of the most widely known varieties of cider-apple in south Normandy: they belong to the first two classes, acid varieties being very rare in that region. The common varieties of other cider-producing regions, such as Brittany, the districts of Othe and Thiérache, will also be studied.

From the table it will be seen that the varieties are classified thus:

Sweet varieties: *Aufrique, Binet blanche, Binet rouge, Bisquet, Bonne hamarière, Bouteille douce, Cécile de Caumont, Doux-Evêque, Doux-Normandie, Haut-Grisé, Herbage sec, Joly rouge, Longuet, Manerbe, Marin-Myroy, Orange, Rouge-Bruyère, Rouge-Durd, Rouge-Mulot, Rousses (Latour nd de l'Orne), Saint-Martin.*

Bitter-sweet varieties: *Amer-Doux, Amer (Petit), Ameret blanc, Ameret rouge, Argile grise, Barbarie sale, Bédan, Bergerie, Cimetière, Citron, Crolon, Domaines, Doux-Lozon, Douze à gobe, Fréquin rouge, Gallot, Gros*

Average content of malic acid, tannin and pectins, in grms per 100 cc. of pure apple juice.

Varieties	Malic Acid	Tannin	Pectic substances	Varieties	Malic Acid	Tannin	Pectic substances
Bitter-Sweet.	0.262 grm.	0.235 grm.	0.39 grm.	Red Fréquin	0.166 grm.	0.288 grm.	0.40 grm.
Bitter (Small).	0.202	0.337	2.65	Gagnevin.	0.146	0.182	1.25
Ameret White.	0.187	0.399	1.00	Gallot	0.177	0.296	0.36
Ameret Red	0.157	0.310	0.66	Red Gros Molots.	0.206	0.317	1.10
Argile grise	0.172	0.260	1.53	Haut-Bois	0.157	0.180	1.50
Auriche	0.164	0.183	1.28	Haut-Grise.	0.232	0.171	1.60
Barbarie Dull grey.	0.170	0.200	1.53	Herbage sec	0.181	0.200	0.73
Bédan	0.136	0.173	0.76	White Joly	0.136	0.224	0.74
Bergerie	0.236	0.304	0.75	Red Joly	0.158	0.195	0.48
Binet White	0.153	0.231	0.57	Longue	0.170	0.170	0.87
Binet Red	0.170	0.191	0.18	Manitb.	0.136	0.200	1.01
Blasquet	0.205	0.140	0.70	Marin-Onfroy.	0.145	0.120	1.20
Bonne-Chambrière	0.188	0.152	0.33	Moulin à vent	0.293	0.464	1.17
Bouteille Sweet	0.276	0.133	1.10	Musackit (Pelti)	0.130	0.230	0.65
Cimetière	0.136	0.210	0.60	Noël Deschamps	0.206	0.348	1.90
Citron	0.191	0.200	0.63	Orange.	0.136	0.170	1.13
Côte de Caumont	0.157	0.159	1.75	Or Méric.	0.270	0.310	0.80
Croton	0.207	0.347	0.10	Ozane	0.262	0.245	0.21
Domaines.	0.164	0.215	0.46	P'eau-de-vache, nouvelle.	0.150	0.260	1.48
Sweet-Evêque	0.166	0.133	1.50	Rouge-Buyère.	0.187	0.125	1.10
Sweet-Lozon	0.136	0.263	1.60	Rouge-Duret	0.157	0.118	1.40
Sweet-Normandie	0.246	0.120	0.50	Rouge-Mulot	0.150	0.144	0.43
Douce à gôber	0.259	0.270	0.45	Rousses (Latour et de l'Orme).	0.250	0.134	1.82
Feuillet	0.205	0.270	0.16	Saint Martin	0.191	0.177	0.82
Flav.	0.150	0.120	0.14	Saint Paulin.	0.160	0.260	0.75

Malois rouge, Joly Blanche, Moulin-d-Vent, Muscadet (Petit), Noël Deschamps, Or Milcent, Ozanne, Peau-de-Vache nouvelle, Saint-Philbert.

The excessive bitterness of a variety can be much diminished by allowing the fruit to attain complete maturity as long as they remain healthy: at the same time both sugar and pectic substances are gained, both valuable from the point of view of making jelly.

15 - *Varieties of American Peach-tree Introduced into Italy.*—ZAGO F., in *L'Italia agricola*, Year 53, No. 11, pp. 497-498, 1 coloured plate. Piacenza, Nov. 15, 1916.

During the last few years, the Rossi brothers of Montescudaio (Pisa) have imported, mostly from the nurseries of Mr J. C. HALE of Winchester, Tennessee (U. S. A.), over thirty new American varieties of peach tree remarkable: for their resistance to adverse weather conditions; for their vigorous habit; their abundant and regular production of fruit; by their fruit whose flesh is usually free from the stone, as in those American varieties previously introduced the flesh usually adhered to the stone.

The writer was one of the first to test the varieties introduced into Montescudaio, and has put about 20 into cultivation, on which observations have been made for about 5 years. It can now be stated that the varieties: "Victor," "Waddel," "Admiral Dewey," "Carman," "Belle of Georgia," "Thurber," "Elberta," "Goldmine," "Old Mixon Free," "Matthew's Beauty," "Chairs' Choice," "Gordon," "Henriette," have the necessary qualities (vigorous plants of sufficient cropping power), and that several, like: "Elberta," "Matthew's Beauty," "Admiral Dewey," etc., are of very good habit, or crop constantly and sufficiently highly, like "Carman," and "Goldmine." A coloured plate is given of the variety "Chair's Choice" or "Crawford Late Improved." It is a vigorous plant, standing adverse weather conditions well, not exacting, with a regular branch-system, with abundant and even ample foliage; it regularly produces abundance of fruit. The peaches are large, with a yellow skin, with spots of bright red and velvet shades; the flesh is yellow, juicy, tender, sweet, of delicate taste, and not adhering to the stone. It originated in Maryland. There is another and earlier (August) Crawford variety, but the one mentioned is the better, as much because of its cropping powers as for the large size and good quality of the fruit.

16 - *Citrus Conditions in Florida, Cuba, and California.*—FAWCETT H. S. in *California State Commission of Agriculture Monthly Bulletin* No. 9, Vol. V, pp. 321-337. Sacramento, September 1916.

The writer compares some of the differences in horticultural conditions and practices in California, Florida and Cuba in special reference to citrus culture.

Florida's citrus regions lie between about 25 to 30 degrees north latitude with 40 to 60 inches of rainfall during late spring, summer and early fall. California's citrus regions lie between 32 ½ and 39 ½ degrees with 10 to 20 inches of rainfall during late fall, winter and early spring.

Florida, therefore, has a moist, humid atmosphere during most of the growing season, making it possible to grow citrus fruit without irrigation.

while California, during this same season, has a dry atmosphere without rains, making it necessary to practice irrigation.

In Florida, cultivation is usually discontinued throughout the rainy season of summer, and in California is usually kept up during the summer because of the necessity of frequent irrigations and the conservation of moisture in the soil.

In Florida, cover crops of Beggarweed, cow peas, velvet beans, etc. are grown in summer, while in California, unless irrigation water is plentiful, summer cover crops give way to winter cover crops of vetch, *Medicago*, etc.

In Florida, the soils are generally light and sandy and require large amounts of plant food for the best growth of citrus fruits, while in California, although the citrus soils are much more variable they average much heavier with a greater amount of clay, therefore, much richer in plant food.

The large number of standard varieties of both oranges and grapefruit in Florida give way to only a few standard varieties of oranges and one standard variety (Marsh Seedless) of grapefruit in California.

Lemons not now grown commercially in Florida are a very important crop in California, while grapefruit, on the other hand, is a very important crop in Florida and is of only secondary importance in California.

What is said about Florida is true for the most part as regards Cuba, except that Cuba lies between about 18 and 22 degrees north latitude and that the application to the soil of a continuous cover of vegetable mulch is practised more extensively.

The average soil of Cuba is heavier and richer in plant food than in Florida. Lemons, not grown in Florida, are grown commercially to a small extent in Cuba and grapefruit occupies three fourths of the commercial plantings.

47 - Drought-resisting Stocks in Hérault, France. — MALLET L., in *Le Progrès Agricole et Viticole*, Year 33, No. 46, pp. 470-473, Montpellier, Nov. 12, 1916.

In 1912, the writer planted a 12 hectare vineyard on the hillside in the commune of Saint-Drézéry (Hérault, France), intercalating several experiment fields, with the object of testing the resistance to drought of several stocks. The results described were obtained from the "Red" field, which has a very homogenous soil, formed by a flinty grit and mixed with round stones; this soil belongs to the Bartonian Eocene and was formed by the decomposition of conglomerate mixed with alpine diluvium. The field was steam-cultivated to 80 cm. deep without touching the sub-soil.

The soil is of good physical condition, but poor in nitrogen, phosphoric acid, magnesia and lime. The experiment field, placed in the middle of a large vineyard planted with the Riparia variety, was spread over a hillside facing south. The rows of the various stocks 106-8, 101-14, 3 309, 333, 41-B, Lot, 157-11, 420-A were planted down the slope; all the stocks were grafted with the Aramon variety. The vine-yard was planted with root-grafts in 1912-13. The first foliage was produced in 1913, the second in

1914, the third in 1915 (first producing year, one of mildew and dryness), its fourth in 1916 (second producing year, great drought). The relative merit of the stocks was determined by comparison with Riparia. Tables are given to show the results of the last three years of observations, which gave the following conclusions: In 1914, the best results were given by: 106-8, 101-14 and 3 309; the Lot variety does not merit any special consideration; 420-A did badly. In 1915, No 106-8 was the best for resistance to drought, while 101-14 comes second. In 1916, No 106-8 came first for vegetation, production of fruit, resistance to drought; 101-14 may be classed on the same footing, but was more woody; 3 309 follows. The author was obliged to conclude that 106-8 would give a sure and constant crop in years with mildew and drought. No. 101-14 seems to possess the same qualities, with more vegetation and a lesser demand for manures.

18 - "**Pellaverga**", a good Italian Table Grape. — LISONNI E. C., in *L'Italia agricola*, Year 53, No 11, pp. 489-491, 2 fig. Piacenza, November 15, 1916.

Attention is drawn to this variety, which apparently is not grown save on the hills of Saluzzo, though it is well worth cultivating more extensively as a producer of one of the best table grapes, easy to pack for carriage and of good keeping qualities (till the following spring).

The grapes are very large, with big seeds, thin but strong skin, a dark pink colour, firm pulp, very tasty and sweet. The "pellaverga" variety is easily adaptable to northern Italy, as it resists intense cold well when in unfavourable situations, but it does best on hill sides facing the sun.

9 - **Forest Management in Morocco.** — LONG, in *Revue des Eaux et Forêts*, 5th. Series Year XVI, Vol. L, IV, No 6, pp. 178-181. Paris, 1916.

From the Author's report on agricultural organisation in Morocco, the following information is obtained as to the Waters and Forests Department in Morocco.

This Department, started in 1913, could only be organised in 1914, and although the staff was considerably reduced (2 superior officers and about twenty officers and French forest-guards). The result of the first working year (1914-1915) may be considered as encouraging, as the receipts have almost equalled the expenses. The magnificent forest of cork-oaks at Mamora, rapidly being destroyed by the natives, has been put under regular control. The cork from 120 000 feet has been utilised in 1914-1915, and up to the present the control of two other forests has been organised.

In addition, about 60 miles of fire lines nearly 100 feet wide have been opened out; in 1915, three groups of ranger's houses were established, and others in 1916, at the price of 25 000 fr. (£ 988) per house, each capable of accommodating the guard's family as well as the native staff and also suitable as a store, etc.

The expenses for the first three years are as follows (in francs) :

Renovating woods spoilt by the natives; cutting stumps of mutilated tree feet that would otherwise have soon died	800 000 fr.
Opening fire-lines in such places where fires have occurred during the last 2 years, or are likely to occur.	600 000 "
Construction of 20 to 25 ranger's houses	1 000 000 "
Nurseries, establishment, and various.	100 000 "
Utilisation of the wood at 0.30 fr. per foot for 6 million feet	2 000 000 "
Total Expenses	4 500 000 fr.

The forest administration is of the opinion that, under such conditions, the full utilisation of the Mamora forest and other cork-oak forest in the Rabat region could be attained in 5 or 6 years, which would mean a gain to the state of several millions of francs a year.

The political condition of the Atlas has as yet not permitted the study of a suitable division for cutting of the fine cedar forest situated to the south of Fez and Meknes.

50 - **The Spruce and Balsam Fir Trees of the Rocky Mountain Region.** — SUBWORTH, G. B., *United States Department of Agriculture Bulletin No. 327* (Contribution from the Forest Service, Professional Papers), pp. 1-43 + Plates I-XXV + Maps 1-10. Washington D. C. 1916.

A dendrological study of the following forest trees.

1) Spruces: *Picea Mariana* (Mill). B. S. and P. known as the "black spruce" — *Picea canadensis* (Mill) B. S. and P. known as the "white spruce," rare in the Rocky Mountains, its main range being Canada and the north-east of the United States — *Picea Engelmanni* Engelmann, called "Engelmann's spruce" — *Picea Parryana* (André) Gardeners' Chronicle, known as the "blue spruce," or "Colorado Blue Spruce."

2) Balsam Firs: *Abies balsamica* (Linn.) Miller, known as the "balsam fir" — *Abies lasiocarpa* (Hook) Neittall, known as the "Alpine fir" — *Abies arizonica* Merriam, known as the "cork fir" — *Abies grandis* Lindley, known as the "Grand fir," or "white fir" — *Abies concolor* (Gord) Parry, known as the "white fir," properly so-called — *Abies magnifica* Shastensis Lemmon, known as the "Shasta red fir."

The distinguishing characters of the above trees are given, together with their geographical distribution, from Mexico to Canada, from the Pacific slope to the Great Plains of North America and in the forest reserves.

It must be remembered that spruces are exceedingly important trees, both from the ornamental standpoint ("blue spruce"), and from the economic point of view. They yield superior saw timber ("white spruce" and "Engelmann's spruce"), and are used for the production of paper pulp (black spruce" and "white spruce").

The larger species of balsam firs produce excellent saw timber ("white

fir"), and wood pulp for paper making, (*Abies balsamica*); while some of them are important also because they form protection forests on steep slopes at high elevations where few other conifers can live.

LIVE STOCK AND BREEDING.

- 51 - The Comparative Values of the Intra-Dermal-Palpebral Mallein Test and the Examination of the Blood for the Diagnosis of Glanders. — FROHNER, in *Monatshetta für praktische Tierheilkunde*, Vol. 27, No. 9-10, pp. 416-424; No. 11-12, pp. 465-511. Stuttgart, 1916.

1. In 1915, the author was asked by the Prussian Minister of Agriculture to conduct comparative experiments on about 100 horses to decide the value of the eyelid mallein test and the examination of the blood.

From the point of view of diagnosis the two tests give practically the same results. Some cases of glanders can be proved by a blood test, and others rather by the eyelid mallein test. Thus the two tests should be combined in practice, especially if many horses are to be examined. Besides, they should be combined in such a case as when one or the other alone gives doubtful results. In cases of acute glanders, both tests may not uncommonly prove useless; then clinical examination is the surest and most generally sufficient method.

The eyelid test is simpler and easier than examining the blood. The taking of blood samples from a large number of horses is difficult and lengthy, especially if repetition is necessary, so the author is informed by the official veterinary surgeons of the "Magerviehhof" (market for ill-conditioned animals) of Friedrichfelde and by those of the central abattoir of Berlin. In addition, the difficult and complicated laboratory examination must be added.

Experiments made at the central abattoir in Berlin agreed with other results and have shown that the eyelid mallein test has no influence on the examination of the blood, as was formerly thought.

According to the authors' observation, the taking of the temperature at the same time as the eyelid test, which is advised by PROF. SCHMIDTNER of Vienna, can not be done with a great many horses. These observations further showed that horses with glanders do not always show a rise in temperature, even when the eyelid test give a positive result.

From the point of view of veterinary police, it seems advisable, when carrying out these tests, to divide the total number of horses into small groups as far as possible, while considering their previous conditions in the stable. Thus, if some of these small groups are found to be free from glanders, the return of the sound animals can be carried out more quickly.

From the technical point of view, the mallein tests have given rise to the following observations: 100 horses can be mallein-tested in an hour.

Before testing, any secretion of the eyes should be observed accurately, as regards the kind (serous, mucous, or purulent) and the quantity (1-1.5

- 2 - 2.5 - 3). A purulent secretion provides a contrary indication for the examination of the eyes. Small, whitish grey secretions of the size of a lentil and seen in the morning in the interior corner of the eye of many healthy horses, have no importance. In examining the eyes, suspicion should only be entertained in the case of a mucous secretion mixed with pus at least of the size of a pea.

II. — From 1912 to 1916, the Prussian Minister of Agriculture again asked the writer to examine 151 horses which were to be slaughtered by order of the veterinary police as they were suspected of having glanders, as was indicated by the blood test. In 143 horses the presence of glanders was shown by the autopsy. The eyelid mallein test gave a positive result in 141 (i. e. 98.6 %) of the 143 glanders horses; in two it gave a negative result. Therefore the eyelid test failed in 1 to 2 % of the total number of cases of glanders. The blood test gave negative results in 5 cases out of 143, thus failing in 3 % of the cases.

For diagnostic purposes, the eyelid test is seen to be of equal value with the blood test, even for extensive researches. The author is therefore of the opinion that the combined use of the two tests should be legally enforced in Prussia in order to exterminate glanders by the veterinary police.

Many observations are given on the technique of the eyelid examination, the different methods of malleinisation and varieties of mallein, the beginning of the reaction in the eyes, the value of a rise in temperature correlated with the examination of the eyes, the proportion of leucocytes in the blood, etc.

52 - On the Possibility of the Infection of Pigs with the Flukes *Opisthorchis felinus*, *Pseudamphistomum danubiense*, and *Metorchis albidus*. —

CUREA JOAN, in *Zeitschrift für Fleisch- und Milchhygiene*, Year 20, No 21, pp. 323-326. Berlin, August 1, 1916.

To decide the possibility of infecting pigs with these flukes, experiments were undertaken in 1914 and 1915. The Author gave different fish containing larval stages of *Opisthorchis felinus*, *Pseudamphistomum danubiense* (especially in tench) and *Metorchis albidus* (especially in roach) to young pigs.

First of all he gave to a 3 month old pig, for 55 days, in all: 40 tench (*Tinca tinca*) — 8 common bream (*Abramis brama*) — 1 Rudd (*Scardinius leuciscus erythrophthalmus*) and 1 *Aspius aspius*. Dogs and cats were used as controls, being also given tench and roach. In the post-mortem examination of the pig, the author only found 7 adult *Opisthorchis felinus* (7 mm. long by 1.48 mm. broad) in the gall bladder and bile ducts. The control animals, which had been given fewer tench than the pig, contained several *Opisthorchis felinus* and a large number of *Pseudamphistomum danubiense*. The fact that no specimens of *P. danubiense* were found in the pig's liver seemed strange, since according to the writer's experiments the roach (*Cyprinus*) and especially the tench in the Danube are more frequently parasitised by *P. danubiense* than by *O. felinus*.

A second experiment was therefore commenced by giving to another pig for 71 days, in all: 93 tench — 13 roach (*Blicca bjorkna*) and 2 bream.

The autopsy showed that the bile ducts were thickened and full of a greenish-grey, glairy liquid. In the liver of the pig were found 45 adult and 2 immature specimens of *Opisthorchis felinus* and one adult but not mature *Melorchis albidus*. The parasites had developed normally. The liver of his second pig also contained no *P. danubienne*. On the contrary, the controls (dogs) of the second experiment contained, as well as specimens of *Opisthorchis felinus* and *Melorchis albidus*, some specimens of *Pseudamphistomum danubienne*.

CONCLUSIONS. — 1) *Opisthorchis felinus*, and probably *Melorchis albidus* as well, can live as parasites in the liver of the domestic pig.

2) It may be that the pig is not parasitised by *Pseudamphistomum danubienne*, but further experiments are necessary to decide this question.

3) The presence of abnormally developed specimens of *Opisthorchis felinus* and *Melorchis albidus* in the liver of the domestic pig may perhaps be explained by the fact that the latter is not the final host of the *Distomatida* in question.

3. The Control of Contagious Epithelioma in Chickens by Vaccination; Experiments in Nevada, U. S. A. (1). — MACK WINIFRED B. and RECORDS EDWARD, in *The University of Nevada, Agricultural Experiment Station, Bulletin No. 84*, 32 pp. 19 fig. Reno, Nevada, 1916.

During the winter of 1914-1915 and the following spring, there occurred in Reno (Nevada, United States) a serious outbreak of a disease (or group of diseases) known in the United States under various names. Those in more common use are "contagious epithelioma," "chicken pox," "diphtheria in chickens," "roup," "canker," "swelled head," "sore head" and "petite herole," to which correspond the French names "épithéliome contagieux," "diphthérie des oiseaux" and "cancer" (2).

The writers thus were able to study the disease upon a somewhat extensive scale. The account of this work was published in the *Nevada Agricultural experiment station Bulletin No 52* in June 1915; the Bulletin here analysed presents the results in popular language with some amplifications, and summarises them as follows:

The identity of contagious epithelioma and diphtheria, or roup, of chickens, is with respect to its cause, a subject of controversy which will require further extended research to settle. For that reason, it is uncertain whether the cases dealt with in the experiments recorded in the bulletin in question were caused by pure contagious epithelioma virus, or were due to mixed infection.

The vaccination of flocks of chickens, in which contagious epithelioma has appeared, with attenuated virus prepared from the morbid products of the disease (according to the method described by MANTEUFEL and later by ADLEY and BEACH in the *California Agricultural Experiment Station Circular No 145*, Dec. 1915), promptly checked the spread of the disease and had a markedly curative effect upon obviously infected birds. Cases of the

(1) See also *B. December 1915 No. 1313*.

(Ed.)

(2) Cf. CAGNY et COMBAT, *Dictionnaire vétérinaire*, Paris, Baillière, 1904.

(Ed.)

disease thus treated were less prolonged and milder than untreated one and the mortality was materially reduced. Two injections were sufficient in most instances, but severe, advanced cases benefited by a third and larger dose.

Flocks containing 4 524 birds, 2 763 of them showing no symptoms but severally exposed, and 1 761, or 38.94 per cent. visibly infected, were success fully treated by vaccination. The spread of the disease after treatment was negligible. The mortality was 373 birds, or 8.24 per cent of the entire number in the flocks, and 21.18 per cent. of the visibly infected ones.

In the above flocks, no unfavourable results worth consideration followed the administration of the vaccine. In two other flocks of 110 and 706 birds respectively, serious septic and toxic processes were apparently caused by it. On the whole, nevertheless, the treatment was satisfactory and successful, although the use of the preparation employed is not without danger, so that a more refined product must be devised. The discovery of such a product was the object of the writers' researches. Viewed in its most favourable aspects, contagious epithelioma in fowls is a serious and destructive disease and must be so regarded by both poultry owners and veterinarians who attempt to deal with it.

The duration of the immunity conferred by vaccination is not definitely known. Too great dependence should not be placed upon it as a means of prevention, when exposure is to be encountered several months later until further experience upon that point is acquired.

54 - **Larkspur Poisoning of Live Stock.** — MARSH C. D., CLAWSON A. B., and MARSH in U. S. Dep. of Agric. Bulletin No 365, pp. 1-100 Washington, D. C., September 8, 1910.

Larkspur poisoning, due to different species of *Delphinium*, is one of the greatest causes of loss in western cattle herds in all the mountain regions between Mexico and Canada and from the Rocky mountains on the east to the coast on the west.

The recent experiments conducted by the U. S. Department of agriculture, a report of which is published in this professional paper, indicate that the various species of larkspurs are poisonous to cattle and horses but not to sheep. Except under unusual circumstances, however, horses do not eat enough of the plant to produce any ill effects. From a practical standpoint, therefore, it may be said that larkspur affects cattle only. It was also found that a quantity of the weed equal to at least 3 per cent of the weight of the animal was necessary to produce poisoning.

In the opinion of the investigators the fact that sheep are apparently able to feed upon larkspurs with entire immunity, may be utilized in some cases to protect the cattle. Where larkspur is especially abundant it is desirable to use the range for sheep rather than for cattle, or to combine sheep grazing and cattle grazing in such a manner that the areas infested with larkspur shall be first eaten down by the sheep.

On comparatively limited areas it may be possible to dig up the tall larkspur, but this is frequently too costly a measure to be adopted, and furthermore it is rarely possible to eradicate the poisonous weed completely.

Generally speaking, there are two great groups of larkspurs, the tall and the low.

The low disappear from the range early in July and cases of poisoning from them are usually confined to the months of May and June.

The tall larkspurs live through the summer season, making their first appearance in early spring. This is the time in which they are the most poisonous. After blossoming their poisonous character appears to diminish. Ultimately, it disappears and the plant dries up although the seeds remain poisonous. In Colorado most of the cases of poisoning from the tall larkspur occur in May and June with sporadic cases in July. In other localities the larkspurs blossom later and poisoning may occur as late as August or even September.

On the range the first evidence that the animal has been poisoned is frequently afforded by its falling down. After a short interval it will probably regain its feet only to fall again until the effect of the poison wears off. In severe cases it is ultimately unable to regain its feet at all and dies. Beneficial results may be obtained by treating the poisoned animals with hypodermic injections of physostigmin salicylate, pilocarpin hydrochloride, and strychnine sulphate, followed by hypodermic injections of whiskey when needed.

5 - **Palm Kernel Cake ; Investigations carried out at the University of Leeds.** — CROWTHER CHARLES, in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 8, pp. 734-749. London, November 1916.

The results obtained during the past 2 years by various investigators at the University of Leeds. The whole of the practical work was carried out at Manor Farm, Garforth ("Experimental Farm of the University of Leeds and the Yorkshire Council for Agricultural Education").

Palatability of palm kernel cake. The experiments of MR. H. J. HARVEY have proved that this product is not so readily consumed by stock as many other concentrated foods. There is considerable variation in this respect with cattle, but a uniform difficulty with sheep. In no case did the difficulty however, prove more than temporary. Attention was directed to the possibility of rendering the cake more appetising by the admixture of small quantities of other substances ; molasses, fenugreek etc., but with very little result. The difficulties are naturally less when the cake only forms part of the ration. Numerous tests were made with the following results :

Composition of mixture		Time required for complete consumption Mins
Palm Kernel Cake Parts	Linsed Cake Parts	
—	—	—
4	0	23 - 25
3	1	18 - 20
2	1	14 - 18
1	1	14 - 17
1	2	10 - 12
1	3	10 - 14
0	4	8 - 9

Keeping Properties. — The experiments carried out by W. GODDEN consist of comparative tests as to keeping properties of palm kernel cake and of 6 other kinds of cake. The results obtained are given in Table I.

TABLE I.
Keeping properties of palm kernel cake compared with those of 6 other cakes.

	Percentage of oil in cake (expressed as percentage of dry matter)		Free fatty acids in oil of cake (expressed as percentage of oleic acid)	
	Initial	After 6 months storage	Initial	After 6 months storage
Uncorticated cotton seed cake	5.33 %	5.47 %	61.48 %	87.44 %
« Soyot » cake	6.01	5.85	20.95	65.33
Groundnut cake	11.27	10.25	14.65	56.02
Linseed cake	13.43	14.02	11.23	29.82
Coconut cake	15.59	12.55	5.84	73.45
<i>Palm kernel cake</i>	10.38	10.16	5.70	48.93
Soya cake	6.61	7.22	5.18	16.37

During storage, in the case of the palm kernel cake, there were no changes in the proportions of albuminoids and oil in the cake, nor was there any development of amides. In both the laboratory and the farm, storage tests were made, and it was found that, though under severe conditions, when the cake was stored in a badly-ventilated vessel kept continuously at about 37° C., the palm kernel cake certainly soon became very rancid, all the other cakes did so also without exception.

Digestibility. The experiments on the digestibility of palm kernel cake were carried out on sheep by H. F. WOODMAN at Garforth, and yielded the results given in Table II.

TABLE II.
Coefficients of Digestibility of Palm Kernel Cake compared with Cottonseed Cake.

Constituents	Percentage Digestibility		
	Palm kernel cake	Palm kernel meal	Uncorticated cotton seed cake
Total dry matter	74.2 %	75.5 %	57.7 %
Organic matter	75.9	76.7	58.0
Crude protein	91.0	90.0	74.7
True protein	90.9	89.7	72.0
Oil	97.5	96.4	(100.0?)
Nitrogen-free extractives	83.1	86.0	62.0
Crude fibre	37.1	44.8	34.0

Applying now the respective digestibilities as found by the experiment, the proportions of digestible nutrients in the feeding-stuffs works out as a Table III which allows of a comparison being made of the food value of the 3 products studied in Table II.

TABLE III. — *The Proportions of Digestible Nutrients in Palm Kernel Cake, Extracted Palm Kernel Meal-Cottonseed Cake.*

Constituents	Percentage of digestibility		
	Palm kernel cake	Extracted palm kernel meal	Uncorticated cottonseed cake
Gross protein	16.18 %	16.90 %	16.62 %
True protein	15.86	16.32	14.47
Oil	8.40	1.99	4.55 (estimated)
Nitrogen-free extractives	36.98	40.69	20.70
Gross fibre	5.24	7.36	14.47

Using the formula:

Food units = (Digest. protein + Digest. Oil) \times 2.5 + Digest. Carbohydrates
 - Digest. Fibre we get from the above Table the following "food units."

Palm kernel cake	103.0 food units
Extracted Palm kernel meal	93.8 " "
Uncorticated cottonseed cake	76.2 " "

The influence of Palm Kernel cakes upon the yield and composition of milk. — Experiments made by A. G. Ruston on 5 cows which received the following rations:

Period I. (5th - 26th of June), pasture alone, without cake, or other added food. Palm kernel cake was then introduced gradually during a transitional period of one week.

Period II. (3rd - 24th July), ration consisted of pasture and cake, then other transitional week and finally,

Period III. (1st-22nd. August), pasture alone.

The results of the experiments are summarised as follows: the average of all the animals being given.

Milk yield per head	Period II	23.34 lb
	Average of Periods I and III	22.88 "
Percentage of fat	Period II	3.99 %
	Average for Periods I and III	3.90 %
Milk yield of fat	Period II	0.93 lb
	Average for Periods I and III	0.88 "
Solid-matter in milk	Period II	8.46 %
	Average for Periods I and III	8.50 "
Milk yield of solids-not-fat	Period II	1.97 lb
	Average for Periods I and III	1.95 "

Influence of Palm Kernel cake upon the composition of Butter Fat. — These experiments, which were carried out by H. WOODWARD, consisted in examining, in the butter obtained, the characters furnished by:

- (1) The Koettstorfer number, or the saponification index.
- (2) Reichert-Wollny number; (the number of cc. of a decinormal soda solution required to neutralise the soluble acids volatile in steam that are contained in free, or combined, state in 5 g. of fat).
- (3) Polenske number; (the number for the insoluble volatile acids corresponding to the Reichert-Wollny number for the soluble volatile acids).
- (4) Iodine number.
- (5) Refractive Index.

The writer obtained the data for the butter of 2 cows. The results given in Table IV refer to the product of one of these, and are given as an example,

TABLE IV — *Physical and Chemical Constants of the Butter produced by a Cow Fed on Palm Kernel Cakes.*

	KOETTSTORFER Number	REICHERT- WOLLNY Number	POLENSKE Number	Iodine Number	Index of Refraction at 40°C.
Period I	228.4	31.0	2.55	41.7	1.451
Period II	230.1	30.0	2.47	37.6	1.451
Period III	222.5	25.6	1.24	42.7	1.451
Averages of Periods I and III	225.4	28.3	1.90	42.2	1.451
Increase (+) or decrease (—) due to palm kernel cake	+ 4.7	+ 1.7	+ 0.57	— 4.6	— 0.031

56 - The By-products of the Decortication of Rice in the Feeding of Milking Cows. Experiments at the Zootechnical Institute of the Royal Higher School of Agriculture of Milan, Italy. — GIULIANI R., in *Minerva Agraria*, Year VIII, No. 101, pp. 217-219, Milan, Oct. 15-30, Nov. 15-30, 1916.

In 1915, the Italian Government prohibited the export of the by-products obtained in decorticating rice ("pula di riso") so as to assure the a certain amount of concentrated food would remain in the country. Yet it appears that no advantage was taken of this fact, so much so, that as considerable amounts had accumulated, export was again permitted. In 1916 the export was again prohibited, and, considering the lack of foreign all hesitations of breeders must be overcome as to the use of a food that can be obtained on good terms. It may be said that the use of the by-products is practically limited to the rice-growing regions, but it is con-

prehensible, considering the total production of rice in Italy (1) that the use of these by-products might increase if their physiological and economic advantages for cattle-feeding were clearly shown. The Director of the Higher School of Agriculture of Milan has drawn the attention of the Italian Minister of Agriculture to this fact and suggested the tests described in the above publication.

The literature on the subject is discussed and the two qualities of "pula di riso" on the Italian market are mentioned: in the first quality, there is a combined total of nitrogenous and fatty matter of about 24 %, in the second quality of 18 % (2).

These tests were intended to show: a) the feeding value of these by-products, b) their suitability or otherwise for feeding cattle and how and in what amounts they should be given; c) their influence on the quality and quantity of the milk; d) if they can be economically used for feeding dairy cattle, and up to what limits.

For these tests, 8 cows of the brown alpine variety were used, the test lasting 84 days, divided into 3 periods and 2 transition phases. During the first period of 15 days, the animal received a basal ration of grass, hay and bran; during the second period, after a transition phase, they had a ration of grass, hay, and "pula di riso" for 30 days. After another transition phase, there was a third 15-day period also with hay, grass and bran. To 4 cows were given 24% "pula di riso," at the rate of 0.770 kg. per kg. of bran, and to the other four 18% "pula di riso" at the rate of 0.860 kg. per kg. of bran, the quantity of "pula" given each day to each cow varying from 0.800 kg. to 2.580 kg.

The health of the animals remained good, save with those receiving 2 to 2.5 kg. of "pula" which had a certain frequent cough, which ceased on reducing the quantity of "pula."

The live-weight during the second period remained nearly constant or even slightly increased.

In comparing the average milk production during the period of feeding with "pula" with that of the other two periods, it is seen that the quantity of milk had not varied in any way that could be attributed to the substitution of "pula" for bran.

As regards the quality of the milk, there was a slight alteration in the fat content during feeding with "pula," while the physical and organoleptic characters remained about the same.

(1) See: International Institute of Agriculture, Bureau of Agricultural Intelligence - International Trade in Concentrated Feeding Stuffs, No. 2, 1916.

(Ed.)

(2) See: C. BÖMMER, Die Kraftfuttermittel, III, 5, pp. 244-265. Berlin, 1903. — O. EYBARD, Reis und Reisabfälle. Die Futtermittel des Handels, herausg. durch den Verband anst. Versuchs-Stationen im Deutsche Reich, XVI, pp. 262-280, Berlin, 1908. — W. A. HENRY, Feeds and Feeding, A Handbook for the Student and Stockman, XIth. Ed., passim. Madison Wis., 1911.

(Ed.)

Regarding the *economic results*, the following foods were given :

1st and 11th periods: total 30 days		11th period: 30 days	
Grass	144 quintals	Grass	144 quintals
Hay	7.20 "	Hay	7.20 "
Bran	5.25 "	24 % "pula di riso"	1.79 "
		18 % " " " "	2.19 "

The prices of bran and "pula di riso" on the Milan market were:

Wheat Bran	22.50 francs per quintal
24 % "Pula di riso"	13.00 " " "
18 % " " " "	10.00 " " "

Calculating from these prices, it is found that the bran for the 8 cows cost 118.12 fr., while the "pula" only cost 45.25 fr., which gives a saving of 72.87 fr. a month.

The results of these tests may be stated thus :

- 1) The by-products from decorticating rice are not injurious to animals ; but in no case should more than 1.5 to 2 kg. per head per day be given, as a larger amount causes a cough in the animals.
- 2) These by-products, given according to the indicated amounts, do not appear to injure the quantity or quality of the milk.
- 3) Under present conditions in Italy, "pula di riso" is a feeding stuff that allows considerable economy in feeding milking cows.

57 - **The Effect of Carrots on the Colour and Quality of Butter.** - In *Mark Lane Express Agricultural Journal and Live Stock Record*, Vol. 116, No. 4449, page 457, London, 1916, October 1916.

The following experiment was carried out at Wye Agricultural College, (England) to ascertain: 1) how long a period it takes before a change of colour becomes marked; 2) what is the minimum quantity of carrots required to alter the tint; 3) will a mixture of carrots and mangels answer the same purpose; 4) what effects have carrots on the churning character of the cream, the quality of the butter, and the percentage of fat in the milk.

For the experiment four cows of the Lincoln Red breed were picked out, the animals having calved down a few months previously.

Two of the animals were fed on 81 lb. of carrots and their ordinary allowance of cake, meal, and hay. Two others were fed in a similar way, mangels being substituted for carrots. The records were taken in February and March, and the feeding reversed - i. e., carrots being substituted for mangels after the first month of the trial. The carrots used were Sutton's Red Intermediate.

A brief summary of the results is as follows :

Length of time before the effect on the colour is apparent. Butter made from carrot-fed cows.

1st week. - Very slight difference compared with that made from mangel-fed cows.

2nd week. — Difference more marked, less time occupied in churning and better grain and flavour.

3rd week. — A very good high-coloured butter, considering the time of year.

On reversing the order of feeding, it was noticed that the colour was maintained in a diminishing degree over two or possibly three weeks, whereas the cows that had previously had mangels responded slightly to their change of food, and would, no doubt, have done much the same as the other cattle. The experiment did not last long enough to answer finally the question as to how few carrots will give the required tint, but it may be said that half mangels and half carrots gave a more saleable quality of butter than those getting a full ration of mangels.

The change of food had the effect of slightly lowering the butter fat in the milk of one cow, and practically made no difference in the others. In no case did it fall below 3 per cent.

The Registration of Pedigrees in the United States. — WAYNE DENSMORE, (Secretary National Society of Record Associations) in *The Breeder's Gazette*, Vol. LXX, No. 19, pp. 881-882. Chicago, Nov. 9, 1916.

The progress that has been made in live stock breeding in America, admittedly greater than in any other nation when the general improvement in all animals marketed is considered, is largely due to the work of the breeders themselves, working through their record associations. Six years ago representatives of a large number of breeders associations met and organized the National Society of Record Associations with the following purposes: "to advance the interest of all registry associations by devising and perfecting practical methods of preserving pedigrees of purebred animals; by united effort endeavouring to secure the enactment of suitable laws relating to record associations; by securing the adoption of suitable rates by the railroads on exhibition and breeding stocks, and also to do all other business as will, in the judgment of such society, advance the interest of breeders of purebred stock through their respective registry associations."

The data presented by the National Society of Record Associations Table I, concerning 37 register associations, have reference to the 1915 year, and were furnished by the officers of the respective associations.

Practically all American associations came into existence between 1875 and 1890, and a large proportion of these became incorporated between 1881 and 1886. Their first duty was to preserve the purity of their breeds, to issue pedigrees for such animals as could present evidence of eligibility and to maintain records of ownership through their transfer records. Their second function was to promote interest in the different breeds by demonstrating in various ways that purebred animals were more valuable than a money standpoint than common animals.

Liberal appropriations were made for prizes at state, interstate and national fairs or exhibitions. This brought the best of the purebred ani-

	Number of Members	Number of breeders recording	New Members during last year	Number of registrations last year	Number of transfers last year	Approximate amount expended for		
						Special prizes	Field work including test work	Advertising through printed matter
						\$	\$	\$
<i>Cattle.</i>								
American Shorthorn Breeders' Association	800	18 000	—	65 000	7 709	45 000	10 000	1 000
American Hereford Cattle Breeders' Association	6 700	14 000	625	45 000	32 000	41 000	5 000	2 000
American Aberdeen Angus Breeders' Association	3 100	10 000	287	10 274	14 042	15 000	5 000	6 000
American Galloway Breeders' Association	410	1 000	12	1 150	610	1 540	—	10
Red Polled Cattle Club of America	1 000	1 800	81	3 028	1 009	2 775	—	80
Polled Durham Breeders' Association	312	2 500	—	2 267	—	604	—	—
American Guernsey Cattle Club	472	5 000	52	11 114	9 036	3 351	2 004	350
Holstein Friesian Association of America	7 676	23 000	1 345	67 080	66 776	4 807	5 687	21 500
American Jersey Cattle Club	554	23 000	43	33 000	30 574	3 940	2 502	13 500
Ayrshire Breeders' Association	776	—	100	3 600	3 180	1 036	5 768	700
American Polled Hereford Breeders' Association	500	1 750	100	1 737	973	400	—	50
<i>Horses.</i>								
Percheron Society of America	7 330	17 000	910	8 402	6 831	8 618	800	1 200
American Clydesdale Association	840	—	150	1 000	950	2 100	—	50
American Association of Importers and Breeders of Belgian Draft Horses	925	—	150	1 128	1 420	3 116	300	14
American Shire Horse Breeders' Association	910	410	54	632	475	822 Silver Trophies	—	—
National French Draft Horse Association	240	—	—	1 213	574	—	—	—
American Suffolk Horse Association	63	121	8	721	38	500	—	11
American Saddle Horse Breeders' Association	303	1 800	—	1 475	300	978	250	—
American Shetland Pony Club	4 800	250	30	1 109	800	750	—	50
<i>Sheep.</i>								
American Shropshire Registry Association	4 715	3 500	113	15 572	3 858	3 602	710	1 000
American Southdown Breeders' Association	357	2 500	12	2 432	1 750	—	—	—

	Number of Members	Number of breeders rearing	New Members during last year	Number of registrations last year	Number of transfers last year	Approximate amount expense for		
						Special prizes	Field work including test work	Advertising through printed matter
						\$	\$	\$
American Rambouillet Sheep Breeders' Association	451	650	9	6 000	1 548	—	—	—
American Oxford Down Association	504	2 000	16	3 169	700	150	—	—
American Costwold Association	240	350	—	—	—	400	—	100
American Cheviot Sheep Society	196	200	11	612	270	—	—	—
American Dorset Club	183	200	17	1 215	787	500	—	140
American Hampshire Sheep Association	851	1 250	54	10 415	2 916	1 000	—	—
American Lincoln Sheep Breeders' Association	109	122	14	1 650	128	352	—	10
American Delaware Merino Sheep Association	25	25	—	112	2	—	—	—
Summe.								
American Berk-hire Association	642	15 000	192	14 940	14 118	1 700	—	1 795
American Poland China Association	2 535	11 700	76	25 350	—	3 500	2 500	2 000
American Yorkshire Club	346	800	14	1 808	175	105	—	157
American Poland China Record Association	885	1 200	36	5 000	500	—	—	—
American Poland-China Record Association	1 232	10 000	93	22 675	1 000	433	311	99
American Mule Foot Hog Record Association	130	5 000	10	1 462	745	—	—	—
American Duroc Jersey Record Association	5 468	10 000	105	35 603	7 000	2 013	—	701
American Duroc Jersey Sire Breeders' Association	1 700	8 950	287	17 100	17 000	3 200	500	950

is prominently before the public, where their points of superiority could be studied.

The promoting work done through the agency of prize moneys was supplemented by solid arguments regarding the economic advantages of purebred animals over scrubs.

These activities promoted the rapid distribution of purebred stock, and the powerful influence of organized breeders secured legislation more just and more favourable to live stock breeders. In the data presented the

limited number of transfers made by the Shorthorn association is due to the fact that a system of transfers was not inaugurated until March 1915, while nearly all others have required transfers for many years or from the very beginning.

The number of breeders doing business with the associations is vastly greater than the membership.

The number of registrations of horses is much less, in proportion to the number of breeders engaged, than in the cattle associations, as the general use of purebred mares has only recently become widespread, but rapid progress is certain to be made in future.

The record wool and mutton prices have given a new impulse to sheep raising and the hard work done by the sheep breeder's associations in past years will soon bear an abundant harvest.

Pig breeders have probably done more in the work of improving common stock than the breeders of any other species of animals and the thousands of uniform carloads of hogs afford ample evidence of the successful use of purebred boars.

CATTLE

- 59 - **Milk Production and Age.**—WOODS, CHAS. D., in *Special Report of the Maine Agricultural Experiment Station for the Commissioner of Agriculture for the year 1914*, pp. 35. Orono, Maine, 1915.

In connection with the studies of the inheritance of milk production in progress at the Maine Experiment Station, the problem of correction to apply to milk production records for the changing age of a cow has been studied and tables are being prepared by which it will be possible, knowing a heifer's milk record, to read off her probable production as a mature cow. Furthermore, it will be possible for a dairyman to give each one of his cows an absolute rating in comparison with advanced registry animals of the same breed at any given age. If he will keep a milk record, he can with the help of these tables, say whether or not a particular cow is better or worse and by what proportion, than the average of advanced registry cows of the same age. The work on Holstein-Friesian and Jersey cattle is now practically completed.

- 60 - **On the Holding up of Milk by Cows** (1).—ZWART S. G., in *Zeitschrift für Tier- und Milchhygiene*, Year, 20, No. 24, pp. 373-375. Berlin, Sept. 15, 1916.

After considering the work done on this subject, it is concluded that there are two phases of the phenomenon of the retention of milk by cow, viz: 1) true holding up; 2) the milk does not flow. These two phases have quite different causes giving the same result, that is, a reduction in the milk produced.

In explaining the first phase, the Author agrees with HESS in that a cow may be frightened during milking by various causes (dogs barking, blows, etc.); she then holds up her milk and milking is of no avail. The truth of this observation is demonstrated by the fact that on inserting a milking tube in the teat of a cow holding up her milk a certain amount of

(1) See B. Aug. 1916, No. 884.

milk was obtained. If the stoppage had been caused by the premature interruption of the second phase, milk could still have been obtained. The stoppage of the flow of milk probably originated in the teat.

Regarding the second phase: the cessation of the flow of milk, it does not take place suddenly, but is observable at the beginning of milking. The milking is completed sooner and less milk is obtained. At the end, the teats are flaccid and shrivelled, and no more milk can be obtained with a milking tube. The cause is, in this case, a decrease in milk secretion during the second phase, resulting from some lesion either of the mammary gland nervous system, or possibly other organs, whose pathological state can, by reflex action, exert a deleterious action on milk secretion. This condition does not prevent the milking being completed.

51 **Advances made in 1916 by the Four Leading American Breeds of Dairy Cows.**

CALDWELL W. H. (Secretary American Guernsey Cattle Club) MACMONNIES W. (Chief Extension Dep. Amer. Jersey Cattle Club) VANDERSLICE J. A. (Holstein Friesian Association). WINSLOW C. M. (Secretary Ayrshire Breeders Association). — *The Field Illustrated*, Vol. XXVI, No. 10, pp. 836-837; New-York, October 1916.

The Guernsey. At the last annual meeting of the Guernsey Club the report showed that during the last five years the work of the Guernsey Register had increased 139%. In the first four months of the present year more than 20% more sales or transfers of Guernseys have been reported than in the same period of last year, while there has been a notable gain in the number of entries. In spite of the disturbing conditions importations numbered 500 head. The number of cows under advanced Register test increased nearly 20%.

The continued increase in the average yield of both milk and butter in the Advanced Register shows that for 5135 cows the average is 53.84 pounds of milk and 441.49 pounds of butter fat with an average percent of 49.86.

All over the country the increasing numbers of Guernseys and Guernsey grades is very noticeable.

The readiness with which dairymen are increasing the percentage of their herds with Guernseys shows that the ability of the Guernsey to tone and color up the products is being more and more appreciated. The natural colour and fine flavour of Guernsey products as well as the ability of the Guernsey cow to produce them most economically is a corner stone for the future of the breed.

The Jersey. — To the student of dairy conditions and even to the outsider with only a perfunctory knowledge of breeds and breed politics, the upward movement in Jersey circles within the past year has been very evident, but to one intimately associated with the workings of the club, and familiar with the attitude of the farmers and breeders, it has been remarkable.

Jersey breeders play an active part, with their herds well in the forefront, in the workings of the 360 cow-testing associations of the United States.

Registration from April 1 to August 1 this year shows an average

gain of 300 per month over a year ago. Because Jersey breeders have always made it a point to keep their stock registered up-to-date, this increase is gratifying. In number of transfers, however, the real activity is displayed. In 1916, 2044 more animals were bought and sold in the five months from April to August, than in the same period in 1915. Jerseys are selling readily and demand for good stock exceeds the supply. Furthermore in this period, April 1 to August 1, 1916, 1996 new breeders began to register and sell stock. These new breeders include only the who have registered stock and are exclusive of those Jersey breeders who have not yet recorded animals of their own breeding. This class constitutes a large percentage of the new breeders, and gives a fair idea of the large number of new Jersey herds being founded.

A marked improvement in the Jersey from the standpoint of type readily noticed by any one who has attended the fairs and dairy cattle shows. There are more cows of superior quality in the ring to day than there ever were before. In regard to production the past year has witnessed remarkable strides forward.

From January 1 to July 31, 1914, 460 tests were accepted. In the same period in 1915, 779 tests were accepted, and in 1916, 1217 tests, an increase of almost 300 per cent, over the same period in 1914.

The Black and White. The growth of the Holstein-Friesian Association and the increase in number of this breed of cattle on American farms is based on the great inherited capacity of milk production.

This capacity has been increased considerably during the twelve months just passed. *Lutske Vale Cornucopia* made a record of 7847 pounds of milk and 26.4 pounds of 80 per cent, butter in a period of seven days. A more recent record for fat production in the junior four-year-old class was made by *Queen Piebe Mercedes* which produced in one year 30230 pounds of milk and 1111.50 pounds of fat, her fat test being 3.68 per cent. The 1200 pound mark was passed when *Duchess Stylark Ormsby* made a record of 1206 pounds of fat, which has not yet been broken. Other great cows in the yearly division were *Ona Buton De Kol* 1076.44 pounds of fat, and *Banosline Belle De Kol* 1075.44 pounds of fat.

In the seven-day division, the butter record as it stood at the beginning of last year was exceeded eight times. In the senior four-year-old class the record was raised from 20.52 pounds of fat from 575.8 pounds of milk to 33.536 pounds fat from 721.4 pounds milk.

The amount of testing done during the past year greatly exceeded that of the year before, the increase in the seven-day division amounting to 123 per cent, for the eight months 64 per cent, and the yearly division 32 per cent. Certified reports of official tests covering 141385 days have been received, verified and accepted, during the fiscal year. The amount of official testing done is equivalent to the testing of 20108 cows for one week.

Considered as a herd of 11858 animals, of which over one-half were heifers with first or second calves, the herd produced within a period of seven consecutive days, 4483885 pounds of milk containing 170011.65 pounds fat, thus showing an average of 3.53 per cent fat. The average

production of each animal was 408.1 pounds milk containing 14.401 pounds

The Ayrshire. The past year in the Ayrshire world as represented by the Ayrshire Breeders Association, has been an eventful one in the increased membership, the growing volume of registry and transfer applications, and particularly in the Advanced Registry work.

From the beginning of official testing to July 1, 1916, the records of 386 cows and heifers have been reported, giving an average annual production of 9 477 pounds of milk and 373 pounds of fat.

This means that Ayrshire milk averages 3.94 % fat, which for the breed as a whole, would mean approximately an average of four per cent fat.

The individual champions in each class that have developed during the past year are :

future : Garclaugh May Mischief	25329 pounds milk	894.91 pounds fat
	1053 pounds butter	3.53 % fat
first year : August Lassie	17784 pounds milk	720.03 pounds fat
	847 pounds butter	4.05 % fat
second year : Lassnessock Buntie	15794 pounds milk	548.44 pounds fat
	640 pounds butter	3.47 % fat
third year : Ethel of South Farm	15056 pounds milk	580.20 pounds fat
	693 pounds butter	3.91 % fat
fourth year : Henderson's Dairy Gem	17974 pounds milk	738.32 pounds fat
	864 pounds butter	4.11 % fat
fifth year : Willowenors Etta 3rd	10621 pounds milk	660.66 pounds fat
	784 pounds butter	4.01 % fat

With the rapidity with which new records are made in each class it is quite evident that the limit of Ayrshire production is not reached.

When systematic breeding as well as systematic feeding are adopted, the fame of the Ayrshire as a breed will be fully established.

The Selection of Dairy Cattle and the Development of Cooperative Associations for the Control of Milk Production in the United States from 1906 to 1916. — *Hoard's Dairyman*, Vol. LII, No. 15, p. 506. Fort Atkinson, Nov. 3, 1916.

The movement in favour of cooperative associations of breeders and producers for the control of the individual production of dairy cows, in view of selection, had its origin in Michigan in 1906. In the course of the last ten years this movement has extended to 38 States, and now includes a total of 346 Associations. Appended is a list of the States which possess the largest number of Associations of this type :

Wisconsin	52	Pennsylvania	10
New York	44	Oregon	15
Vermont	38	Illinois	12
Iowa	23	Maine	11
Minnesota	22	New Hampshire	11
Ohio	20	Michigan	10

The appended Table shows the development of these Societies from the beginning.

*Development of Cooperative Milk Recording Societies in U. S. A.,
from 1st July 1906 to 1st July 1916.*

States	Number of associations at work in										
	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916
Michigan	1	4	2	5	4	3	4	4	3	3	
Maine	—	—	3	4	3	6	5	4	5	8	
New-York	—	—	1	1	3	9	18	21	29	35	
Vermont	—	—	—	2	8	10	11	17	28	33	
Iowa	—	—	—	2	5	4	8	7	8	13	
California	—	—	—	1	3	2	4	4	5	7	
Wisconsin	—	—	—	9	10	10	8	11	24	37	
Nebraska	—	—	—	1	0	0	0	3	2	3	
Colorado	—	—	—	—	1	1	2	1	1	0	
Pennsylvania	—	—	—	—	1	1	2	2	7	14	
Ohio	—	—	—	—	1	0	0	1	4	5	
Maryland	—	—	—	—	—	1	3	3	2	4	
Illinois	—	—	—	—	—	4	3	2	7	3	
Washington	—	—	—	—	1	3	1	0	0	1	
Minnesota	—	—	—	—	—	3	7	10	9	11	
New-Hampshire	—	—	—	—	—	1	1	1	4	8	
Oregon	—	—	—	—	—	1	1	1	7	11	
Utah	—	—	—	—	—	1	0	0	1	1	
Massachusetts	—	—	—	—	—	2	2	2	3	0	
Virginia	—	—	—	—	—	2	2	2	0	0	
Kansas	—	—	—	—	—	—	1	1	1	0	
Indiana	—	—	—	—	—	—	2	2	2	3	
Kentucky	—	—	—	—	—	—	1	1	1	0	
Missouri	—	—	—	—	—	—	—	—	2	1	
New-Jersey	—	—	—	—	—	—	—	—	2	3	
West Virginia	—	—	—	—	—	—	—	—	1	1	
Connecticut	—	—	—	—	—	—	—	—	1	3	
N. Carolina	—	—	—	—	—	—	—	—	2	0	
Louisiana	—	—	—	—	—	—	—	—	1	0	
S. Dakota	—	—	—	—	—	—	—	—	1	1	
Nevada	—	—	—	—	—	—	—	—	—	1	
Arizona	—	—	—	—	—	—	—	—	—	—	
Rhode-Island	—	—	—	—	—	—	—	—	—	—	
Delaware	—	—	—	—	—	—	—	—	—	—	
Idaho	—	—	—	—	—	—	—	—	—	—	
Mississippi	—	—	—	—	—	—	—	—	—	—	
Montana	—	—	—	—	—	—	—	—	—	—	
Tenn essee	—	—	—	—	—	—	—	—	—	—	
Totals	1	4	6	25	40	64	62	100	163	210	

63. **The Numbers of Purebred Schwiz and Simmenthal Cattle belonging to the Breeders' Societies in Switzerland on January 1st, 1916.** — *Landwirtschaftliches Jahrbuch der Schweiz*, Year 30, Part 4, pp. 385-438. Berne, 1916.

The pure-bred Schwiz and Simmenthal cattle existing in Switzerland on January 1st 1916, and registered in the herd books, included the total of 1444 bulls and 51,806 cows, divided as follows: 384 bulls and 21 971 cows of the Schwiz breed: 1096 bulls and 29 835 cows of the Simmenthal breed.

The following table shows: the number of breeders' Societies existing in the various Swiss cantons on January 1st, 1916, as well as the number of members — the number of bulls and cows entered in the herd books of the various Societies on the same date.

Condition of the Cooperative Societies of Breeders of pure Schwiz and Simmenthal cattle, and the total head of cattle on Jan 1st 1916.

Schwiz Breed					Simmenthal Breed				
Cantons	Breeders' Societies		Cattle		Cantons	Breeders' Societies		Cattle	
	Number of Societies	Number of members	Number of Bulls	Number of Cows		Number of Societies	Number of members	Number of Bulls	Number of Cows
Urich	45	2 418	85	5 176	Berne	90	1 838	235	10 093
Schab	30	636	63	3 840	Fribourg	56	5 318	154	7 154
Uriem	25	546	39	2 655	Vaud	131	1 753	554	6 857
Saem	12	440	38	1 979	Solcu	16	302	29	1 378
Bas	9	294	24	1 357	Aigovic	14	616	24	1 217
Basovic	14	334	20	1 085	Lucerne	12	274	24	1 106
Blas	9	411	10	567	Neuchâtel	6	319	11	810
penzell Rhodes Ext.	10	323	12	984	Geneva	18	477	65	697
Basvic	6	229	13	809	Basel-country	8	234	17	434
Swallem	5	139	8	700	Basel-town	1	24	3	91
Basall	6	165	10	631					
Swallem	6	74	11	576					
Bas	5	96	7	441					
penzell Rhodes Int.	3	72	4	374					
Bas	3	119	4	287					

4. **Karakul Sheep Breeding in South Africa.** — (1) HOLM ALEX, (Under-Secretary of Agriculture) in *The Agricultural Journal and Small-Holder of South Africa*, Vol. III, No. 18, pp. 168-174. Johannesburg, June 1916.

Karakul sheep produce the lambskins from which astrakan fur is made, their original habitat being Bokhara and surrounding districts, in Russian Turkestan, between the Caspian Sea and Northern Afghanistan.

(1) See *B.* 1911, No. 2771; *B.* March 1913 No. 282; *B.* Jan. 1914 No. 2; *B.* June 1916, p. 665.

The climate is very dry; hot in the summer, while in the winter intense cold is experienced.

The Karakul sheep have therefore acquired great hardihood and are capable of subsisting on the scantiest fare.

In many respects the conditions of their natural habitat are not dissimilar to large areas of the Union and of South-West Africa, where the Afrikander breed of sheep thrives.

In conformation the Karakul resembles the Afrikander, though it is generally rather larger. It is essentially a hairy sheep. In the adult the hair, which with age turns from black to greyish black, attains a length of 4 to 6 inches. The lambs have a more or less lustrous black hair, in form of curls or locks, which open out at periods varying as a rule from three to nine days. Brown, greyish and greyish-black born lambs are regarded as "fancy".

The great importance of the fur industry has induced Governments and individuals in different countries to introduce Karakul sheep therein. Russia, Austria, Canada, Great Britain, Germany, South West Africa made importations of pure-bred Karakul sheep.

The largest exportations of Karakul, outside of Europe, have been made to South-West Africa, where in 1912 there were 341 pure bred animals and 3753 halfbred. Quite recently 84 of these ewes and three rams have been transferred to the School of Agriculture, Grootfontein Middelburg C. P. in the Union of South Africa. The surplus rams, 49 head, were sold by auction by the Protectorate Administration in October and November last and the average price of £ 22 was realised. Experiments were conducted by the German Government on crossing Karakul rams with Afrikander, Persian, Merino and a few Heidschuhens (German breed) ewes. The best results have been obtained from the Afrikander. The crosses from the Merino and Heidschuhens were unsatisfactory. Experience shows that the skins of half bred lambs are seldom of sufficient quality for marketing, but that a fair proportion of three-quarters and seven-eighths bred skins are of good quality.

Mr. TEINERT states that after being tanned and dressed the three-quarters bred skins, in the first consignment exported by him, realised from 12s. to 45 s. each and that the average price of the entire shipment was 38s. per skin. DR GOLF records that 4s. to 8s. each was obtained for half-bred skins from South-West Africa and the late PROF. KUN stated that his three-quarters and seven-eighths bred skins were valued at 20s. to 30s. each. The report made by M. KARPOV to the Russian Government states that from the Khanate of Bokhara there are exported 1 1/2 th. to 1 1/2 million skins per annum, valued at nearly £ 1 000 000 and that there has been a steady advance in prices for the last 20 years, amounting to 180 %. The chief markets for the raw undyed skins are Nijni-Novgorod and Moscow. The dyeing process has been chiefly done at Leipzig, where about 685 000 skins are handled annually.

Karakul sheep are able to maintain themselves in satisfactory breeding condition on poor and scanty herbage and it has been shown that they

are unsuited to countries possessing damp climates. The ewes breed regularly and generally have only one lamb at each parturition. In Bokhara in certain seasons they suffer from a disease called "djuct", and their lambs are born prematurely. The pelts from these lambs are classified as "broadtail" fur and often fetch much higher prices than the ordinary skin. There is no evidence to support the statement that ewes are killed in order to procure skins of this class.

The lambs reach their highest quality for fur purposes, as a rule, in from three to eight days after birth. The period of maturity of the skin varies with each lamb, and within a day or two after the locks have reached the desired development the quality deteriorates.

In order to maintain or increase the number of the flocks the sales of skins should be confined almost entirely to the male lambs.

South Africa has in large numbers the most suitable foundation stock for grading up, as in the Afrikaner there is a large available supply of ewes, which can be obtained at comparatively low prices.

But apart from the question of production of Karakul skins, there is evidence to show that the mutton producing qualities of the Afrikaner would be improved by the introduction of Karakul blood. The Karakul is rather larger than the Afrikaner and the crosses give greater weights of carcasses. There would be no depreciation in quality of mutton as Karakul mutton is renowned for its quality. It may therefore be emphasised that even if at any time the skins do not meet a good trade there would be no reduction but rather an improvement in the value of the flock for mutton production, while on account of the hardihood of the Karakul and its suitability to dry desert conditions, the cross-bred or grade flock would be equally as hardy as the Afrikaner. Again in the process of grading up, those lambs whose skins are not of sufficient quality for the fur trade will be retained for slaughter stock, and no depreciation in value, as compared with the Afrikaner, will result. The hairy "fleece" of the Karakul is worth about 4 d. per lb. and the return per head per annum from this source is from 15 6 d. to 2s. When the lambs are killed at a few days old less difficulty should be experienced in maintaining ewes in good breeding condition, particularly during a severe drought; the ewes under these conditions should give birth to a large number of lambs within a given time and losses among lambs in unfavourable seasons would be reduced.

In the areas where conditions are unfavourable to the Merino, the infusion of Karakul blood on the Afrikaner stock is likely to be profitable both from the point of view of mutton production and a potential fur industry. In the case of the latter, consistent grading up with pure-bred Karakul rams will require to be practised.

Those who may be disposed to buy Karakul sheep or their crosses, are advised to exercise the greatest circumspection, as the three-quarters and seven-eighths bred sheep are not easily distinguished from the pure bred.

It is matter of first importance to ascertain, if possible, points in the adult which are correlative with quality of fur in the lamb. On a close inspection on the rams and ewes and their lambs in the flock of South-West

Africa, certain points were noted which are likely to prove helpful in determining these correlative features. In the ram and ewe there should be an absence of soft "tight" wool next to the skin. The hair should be strong, dense and curly, or crimped near the skin, which should be black. It would appear that lustre in the lamb is correlative with the lustre on the short black hair of the face, the ears and the legs of the ram and ewe.

Lambs which develop their highest quality of fur at, say, a week or more old would, on the average, be larger than those which attain their maximum quality at, say, three days old, so that the lateness in maturing would be an important and valuable quality. Again, skins are found which are good in parts but are deficient in others. Experiments hitherto made indicate that the best results in crossing or grading up are obtained with the Afrikander ewe, but of Afrikander there exist several types in South Africa. The best type has still to be determined, but it seems reasonable to suppose that the short glossy or lustrous haired Afrikander would be the most suitable.

It is the intention of the Department of Agriculture, with the Karakul flocks now in its possession or under the control of the Protectorate of South West Africa, to make a close study of these points, and a good deal of interesting and valuable information should soon be obtained.

65 - Experiments in Feeding Maize Silage to Lambs at the South Dakota Experiment Station, U. S. A.,-- WILSON JAMES W., in *Dept. of Husbandry, South Dakota State College of Agriculture and Mechanic Arts. Bulletin No 165*, pp. 377-399, 7 figs. Huron, S. D., April 1916.

The above bulletin includes the results of two experiments in feeding maize silage to lambs. It also includes results of other experiments in feeding lambs reported in previous bulletins now out of print.

Lambs turned on the stubble, after the grain is harvested and stacked, provided rape has been sown with the grain, will make a big gain and the manure will be scattered evenly over the field. In the course of experiments made in 1908 and 1909 the average daily gain per head when the lambs received rape pasture alone was 0.34 of a pound, or a larger gain than is usually made when lambs are receiving a full feed of grain and hay.

The best gains ever secured at the Station were obtained in the course of an experiment to determine the comparative value of alfalfa and prairie hay, with the same kind of a grain ration, for the production of a pound of gain. The grain ration consisted of a mixture of 100 lbs. of oats, 100 lbs. of maize grain and 25 lbs. of oilmeal. Each lot was started on one pound per head of the mixture daily, and increased until they were receiving two-tenths pounds per head of grain daily, and what hay they would eat. The average gain per head daily for the lot that received the alfalfa hay was 0.51 of a pound, while with the lot that received the lucerne hay the average daily gain per head was 0.38 of a pound. The lambs were as near the same in weight and age as was possible to get them.

Experience teaches that it pays to let the lambs pick a field of maize; in fact they pick it much cleaner than is done by the average picker

	Lot I	Lot II	Lot V	Lot VI	Lot VII
<i>Average ration during the 2 years of the experiment (per head and per day):</i>					
Maltese silage	1.38 lb.	0.72 lb.	0.49 lb.	0.37 lb.	—
Maize	1.53 lb.	1.52 lb.	1.40 lb.	1.51 lb.	1.51 lb.
Hay	—	0.76 lb.	0.97 lb.	1.23 lb.	1.33 lb.
<i>Results in 1914:</i>					
Average weight at beginning	74 lb.	72 lb.	72 lb.	72 lb.	72 lb.
Average weight at close	85 lb.	92 lb.	96 lb.	93 lb.	95 lb.
Average gain per head daily (87 days)	0.23 lb.	0.23 lb.	0.28 lb.	0.25 lb.	0.23 lb.
Cost of producing 100 lb. gain	\$11.44	\$ 8.45	\$ 7.12	\$ 7.96	\$ 7.45
<i>Results in 1915:</i>					
Average weight at beginning	80 lb.	32 lb.	74 lb.	80 lb.	78 lb.
Average weight at close	85 lb.	93 lb.	86 lb.	92 lb.	88 lb.
Average gain per head daily (60 days)	0.08 lb.	0.18 lb.	0.21 lb.	0.19 lb.	0.16 lb.
Cost of producing 100 lb. gain	\$12.00	\$ 9.69	\$ 8.39	\$ 9.23	\$10.47

Price of feeds taken as basis of calculation:

Grain	1 cent. per lb.
Maltese silage	\$ 3 per ton.
Prattle hay	\$ 6 per ton.

Then too, they will eat the husks and leaves of the maize and nearly all the weeds that have gone to seed. They will clean up the borders of the field that would otherwise remain foul year after year. Sheep prefer the grain in its natural condition and it should be so fed, unless in case of a grain like millet seed when it should be ground coarsely.

The object of later experiments, carried out in 1914 and 1915, was to ascertain to what extent maize silage could be added to the lamb's ration for the best results in fattening. (In previous experiments maize silage had given excellent results with cattle, giving an economic increase in live weight preparatory to fattening). There were 140 lambs used in these experiments, or, in each season, 7 lots of 10 each. Each year lot I was fed maize silage as the sole roughage. Each lot received the same grain ration, consisting of maize and oats mixed half and half by weight. Lots II to VI inclusive were fed silage and prairie hay, with their grain rations, in varying quantities; while lot VII only received hay with their grain rations. The results are summarised in the adjoining Table.

The results show that maize silage is not suitable as the sole roughage ration for fattening lambs with grain. On the other hand, by adding a small quantity of maize silage to the lamb's ration, more uniform and larger gains were made than with lambs not receiving any maize silage.

In lot III which gave the most uniform and economic increases in live weight. A mixture of oats and maize half and half by weight, is not a good ration for fattening lambs.

66 - **Relation of Fertility to Length of Body in Brood Sows** - WESTWORTH E. N., Kansas Agricultural College, in *The Breeder's Gazette*, Vol. LXX, No. 12, pp. 470-471, Chicago, September 21, 1910.

Some interesting figures on the relation of fertility to length of body have been collected on the herd of brood sows last spring at the Kansas Agricultural College. Ten large-type Poland-China, 2 Berkshires and 16 Duroc-Jersey sows were included in the figures. The sows were divided into 6 grades - very long, long, medium long, medium short, short and very short. No sow was included in the last category - definite selection had been practiced in the herd against short-bodied animals. Twenty-one of the sows were in the three long grades and seven were in the two short grades remaining.

The following table shows the results from the five different grades although the numbers in some of the grades are relatively small.

The litter of 20 pigs, of which only 4 survived, can scarcely be charged against the Duroc-Jersey sow that produced them, an abnormal parturition having occurred. If this sow is omitted from the count, the average would almost indicate that it is wisest to select from the short sows, both for large litters and for ability to raise the litter. However, the number are too small to draw positive conclusions.

The 2 Berkshire sows raised every pig, but the average litter was only 6. The 10 Poland-China produced an average litter of 8.8 pigs, of which 72.7 per cent. or 6.4 pigs, were raised. The 16 Duroc-Jersey sows farrowed 9.93 pigs, and weaned 6.06 pigs, or 61 per cent. If the abnormal Duroc

Number of Litters, Average Size and Number Raised by Breeds.

Breed	No.	Size	Raised	No.	Size	Raised	No.	Size	Raised	No.	Size	Raised	No.	Size	Raised
Island Chick.	1	7	5	5	10.67	7	4	7.75	5.75	2	9	7.5	—	—	—
Orpington	—	—	—	1	4	4	—	—	—	—	—	—	1	8	8
Barred- Rock	1	20	4	8	9	5.9	5	9.33	5.33	1	10	5	3	10	9.5
W.	2	15.5	4.5	12	9	6	7	8.43	5.59	3	9.33	6	4	9.25	8.75

ersey litter is omitted the average litter is 9.27, the number raised is 6.2 and the percentage is 66.9.

It is not assumed that these results are characteristic of the different breeds but their individual records are presented so as to show what of the differences related to length of body may be due to breed.

It does not seem as though breed variations in this study affected the litter size when computed on the basis of body length, while it is quite evident that body length has little to do with the number farrowed.

One cannot say that a medium to short body is desirable as a result of this study, but one can suspect that body length is unrelated to fertility. This does not agree with practical experience, but from other studies it appears that these beliefs of experience were perhaps arrived at on rather incomplete evidence.

Studies on the Physiology of Reproduction in the Domestic Fowl: Dwarf Eggs (1).

PEARL RAYMOND and CURTIS MAYNIE K., in *Journal of Agricultural Research*, Vol. VI, No. 25, pp. 977-1042 + Pl. CXII-CXIII, Washington, September 18, 1916.

Researches carried out in the Biological Laboratory of the Maine Agricultural Experiment Station, United States.

Eggs much smaller than normal eggs are occasionally produced by domestic fowl of all breeds. These eggs usually contain little or no yolk, occasionally a small yolk, usually unfertile but inclosed in a complete telline membrane. The albumen is small in amount, and often, but not always it is of a thicker consistency than the albumen of ordinary eggs. The yolk membranes are normal. The shells varies in thickness over the same range as the shells of normal eggs. Sometimes it is entirely lacking, and then the egg is simply covered with a membrane. The writers suggest the name dwarf eggs for these small eggs. Among the various types of abnormal eggs produced by the domestic fowl, the dwarf egg is more common than any other type, except the double-yolked egg. In their article the writers describe:

- 1) The different types of dwarf eggs, both as regards shape and contents.
- 2) Their variation in size and shape.
- 3) The interrelations of the variations in dimensions, shape and size.
- 4) The frequency of the occurrence of dwarf egg compared to normal eggs and of dwarf egg producers compared to birds which do not lay dwarf eggs.
- 5) The seasonal distribution of dwarf eggs.
- 6) Dwarf egg production by fowls with normal and with pathological oviducts.
- 7) The relation of dwarf egg production by normal fowls to the age of the fowl, and the position of the egg in the litter and clutch.
- 7) The physiological conditions leading to dwarf egg production.
- 9) The relation of dwarf egg production to other abnormal phenomena of reproduction which occur in nature, or have been experimentally produced.
- 10) The contribution which the study of the physiology of the production of dwarf eggs makes to our knowledge of the normal physiology of egg production.

The results of this study are summarised by the writers as follows:

- 1) During the 8 years from February 1, 1908 to February 1, 1916, 298 dwarf eggs are known to have been produced at the poultry plant of the Maine Experiment Station (most of the fowls kept being Barred Plymouth Rocks).
- 2) During the 2 years of maximum dwarf egg production, the ratio of dwarf eggs to normal eggs was 1 dwarf egg to 1.158 normal eggs.
- 3) Dwarf eggs are of two distinct types in respect to shape, namely prolate-spheroidal, or oval, resembling an ordinary egg, but with the long axis proportionately short, or else cylindrical, with the long axis proportionately longer than in the normal egg.
- 4) Dwarf eggs of the prolate-spheroidal type are much more frequently produced than cylindrical eggs; in fact, 95.4 per cent of the dwarf egg studied were of the first type.
- 5) Dwarf eggs may also be classified according to the absence of yolk, or its presence either as a small yolk in a yolk membrane, or as free yolk.
- 6) Of the 274 dwarf eggs opened, 35.03 per cent were yolkless and 64.96 per cent, or nearly $\frac{2}{3}$, contained yolk. The yolk was inclosed in membrane in only 9.85 per cent of the dwarf eggs opened, while free yolk was present in 55.11 per cent of these eggs.
- 7) Dwarf eggs with small yolks, while distinctly smaller than normal eggs, are significantly larger than dwarf eggs with little or no yolk.
- 8) A comparison of the relative size of the several groups of dwarf eggs, normal eggs, double-yolked and triple yolked eggs furnishes a continuous line of evidence that the amount of albumen secreted depends, to a large extent at least, upon the degree of immediate stimulation due to the amount of yolk present.

9) Although the evidence available is not sufficient for a positive statement, the shape of the cylindrical egg is probably due to the long form of the stimulating nucleus.

10) Dwarf eggs with small yolks have indices (measurements of the short axis expressed in percentages of the long axis) which are higher than those for normal eggs and lower than those for other prolate-spheroidal dwarf eggs. This difference in index in the three groups is the reverse of their difference in size.

11) This negative correlation between the shape, index and size extends the evidence from former researches, that the smaller the egg, the broader it is in proportion to its length.

12) Two factors may be involved in producing this negative correlation between index and size : a) The area of the glandular mucosa under stimulation must always be related to the size, particularly the length, of the stimulating nucleus (yolk drop, normal yolk, or two or three yolks in tandem) : b) the oviduct, which is a tube with elastic walls, will offer more resistance to the passage of a large than a small body, and therefore when the plastic egg is forced through it by peristalsis, it will exert a greater elongating pressure upon a large than a small egg.

13) Dwarf eggs of every class are exceedingly variable when compared to normal eggs. This greater variation occurs in all the physical characters measures — length, breadth, shape, index, egg weight, yolk weight, shell weight and, possibly, albumen weight.

14) Dwarf eggs with small yolk resemble normal eggs in degree of variability, as well as in size and shape, more nearly than do other classes of dwarf eggs.

15) The several size characters show different degrees of variation. They may be arranged from most to least variable as follows : egg weight, length and breadth. This arrangement is the same for dwarf and normal eggs.

16) It is probable that the variation in yolk weight compared to the variation in the other egg parts and to the whole egg is greater in dwarf eggs with small yolks than in normal eggs.

17) The interrelation of the size and shape characters in prolate-spheroidal dwarf eggs of each class is as follows : a) Length and breadth, length and weight, and breadth and weight are significantly highly correlated in eggs of each group : b) Index and weight are negatively correlated. The correlation is significant for dwarf eggs with little or no yolk : c) In dwarf eggs with small yolks, yolk weight is highly correlated both with egg weight and with albumen weight. The writers discuss the physiological significance of these correlations.

18) From 1908-1916, 5.15 per cent. of all the fowls kept at the Maine Agricultural Station are known to have produced at least one dwarf egg.

19) Both the actual dwarf egg production and the number of dwarf eggs per 1000 eggs is lowest during the winter months. It increases through the spring, reaching a maximum in the early summer.

20) In general, the season of high normal egg production is also the

season for high dwarf egg production both actual and relative to normal egg production. The maximum of dwarf egg production, however, occurs later in the season than the maximum normal egg production.

21) The production of a dwarf egg is usually an isolated phenomenon occurring only once or twice during the life of a bird. Only 3.5 per cent of the fowls which produced one or more dwarf eggs produced more than 2.

22) A study of all the egg records and the available autopsy records for fowls which produced one or more dwarf eggs shows that in most cases the disturbance which caused the production of the dwarf egg was of temporary character, and was not correlated with a morphological disturbance of the sex organs.

23) Of the 200 dwarf egg producers 11, however, showed evidence that a permanent disturbance had occurred. In these cases, few or no normal eggs were produced after the dwarf egg, or eggs, although nesting records indicate that the ovary passed through normal reproductive cycles.

24) Autopsies were made on 5 of these cases, and all of them showed some pathological condition of the oviduct which interfered with the passage of the egg, but did not entirely close the duct.

25) In normal birds dwarf egg production is most likely to occur during the height of the breeding season. It is not associated with immaturity of the sex organs.

26) The popular notion that a dwarf egg marks the end of a period of production is without foundation. A dwarf egg is equally likely to occur at any time during a clutch or litter.

27) A dwarf egg may be overtaken by a normal egg and form one of the components of a compound egg similar to a double-yolked egg, except that one part is a dwarf egg.

28) A dwarf egg after it has received its membrane, or its membrane and shell, may be returned up the duct, and be included in the succeeding normal egg, or it may act as the stimulus for the formation of a larger in closing dwarf egg.

29) Dwarf eggs are produced only when the ovary is in the absolutely active condition associated with the maturing of yolks. This is true whether the fowl has a normal or pathological oviduct.

30) When the sex organs are in this conditions, a mechanical stimulation of the oviduct by an artificial yolk may result in the formation of a complete set of egg envelopes.

31) The mechanical stimulation need not begin at the funnel in order to be effective to the parts lower down.

32) The mechanical stimulation is local in its effect, that is, it is not transmitted down the duct below the point to which it is applied.

33) Dwarf eggs may be, and probably are, often produced by the stimulation of an active duct by some material particle which is not yolk.

34) At least 65 per cent of the dwarf eggs studied, however, were initiated by an abnormal small yolk, or by a part of normal yolk. Certain in some, and probably in all the latter cases, the rest of the yolk was also bed by the visceral peritoneum.

35) Neither the absolute time relation between ovulation and the ability of the duct to respond to mechanical stimulus, nor the nature of the connection between the state of the ovary and the duct is certainly known.

36) It is suggested that the oviduct may be sensitised by some changes in the internal secretion of the ovary associated with the maturation of yolks. If this is the case, the change in the secretion probably precedes ovulation.

The article is followed by a bibliography of 29 publications.

- 68 - *Trigona williana* and *Trigona amalthea*, Wild Bees attacking the Hive Bee in the Amazon Region, Brazil. — VAN EMMELÉN AMARO, in *hazards e Quintais* Vol. XIV, N° 4, pp. 758-759, 1 Fig., São Paulo, October 15, 1916.

The Director of the Agricultural Experiment Station of Cachoeira Grande, in the Amazon Region, has sent to the Author specimens of *Trigona amalthea* Oliv. and *T. williana* Friese, which have completely destroyed the hives of *Apis mellifica* belonging to the Station.

The author describes these two enemies of the hive bee and recalls that a few years ago he had attempted to introduce the breeding of *Apis gustica* (Italian bee) and of *Melipona* sp. ("Mandacá" bee) into Ceará, but the *Trigona* exterminated the swarms of the two species in spite of preventive measures (destruction of the nests of the enemy insects).

- 69 - The Results of Summer Rearing of Silkworms obtained in Piedmont in 1916. — FAVIERO P., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 47, p. 381. Piacenza, Nov. 19, 1916.

By request of the "Associazione serica e bacologica" (Silk Association) of Piedmont, the writer has collected the results of summer breeding of silkworms obtained in 1916 in that district. As a whole, these results seem to show that, of the two second rearings, the summer one (mid-July to mid-August) and the autumn one (August, September and sometimes October also), the first is best suited to Piedmont, as autumn rearing presents the following difficulties: 1) there may be lack of mulberry leaves owing to white frosts or early cold; 2) even with a normal temperature, the leaves soon wither, being old; 3) in vineyards on the level and still more in hill side vineyards the most busy time in rearing corresponds with vintage time and the sowing of winter cereals; 4) artificial heating is necessary, which increases the cost, by no means a small item. On the other hand, with summer rearing the mulberry trees are at their best state of vegetation, having fresh and still tender leaves. Again, at this time there is little other work to be done in the country. If it is carried out rationally, and special attention is paid to the ventilation of the silkworm nursery, summer rearing will give good technical results.

The larvae hatch healthily, they eat the mulberry leaves even if hard, except during the first two stages, during which it is absolutely necessary to give tender leaves, which they eat greedily.

Their different stages are shorter, especially as regards the moult; they grow under the best conditions and produce a compact cocoon, rich in silk

and fine grained. The leaves being drier and the rearing being shorter, generally there is obtained a unit yield per ounce little inferior to that obtained by spring rearing and which can be estimated at 50 kg. per ounce, but which may reach 60 kg. and even more if the rearing is properly carried out. Cocoons obtained by summer rearing fetch slightly more than the spring cocoons.

RESULTS OF REARING $\frac{1}{8}$ OUNCE IN A ROOM IN TURIN.

Emergence of larvae: August 10, regular, in 2 days.

Growth: September 15, regular somewhat slow.

Temperature: 17 to 22° C: windows always open day and night.

Condition of larvae: excellent; no disease; somewhat slow, but this is due to rearing crosses.

Kind of eggs: Chinese double yellow, Maieila female, Chinese gold male.

Number of cocoons required to make 1 kg. days after full growth of the larvae (this time is needed to ripen the cocoons): 600.

Doubles (or dead cocoons): 3%; waste: 1.25%.

Number of eggs in 1 grm. Weight: about 1365.

Percentage of unhatched eggs: 2%.

Yield in cocoons from 10 grm. of eggs: 22 kg.

Price obtained for the cocoons: 6 fr. a kg.

The writer concludes that it would be profitable to summer-rear amounts equal to $\frac{1}{4}$ or $\frac{1}{5}$ of those reared in spring, very much divided, but very numerous.

YIELD AND QUALITY OF THE SILK (TEST BY THE SILK LABORATORY, MILAN).

Average weight of a cocoon	1.67 gr
" length " "	28.80 mm
" breadth " "	14.70 mm
Relation between silk cocoon and pupa; alive, average	100:106
" " " " " dried, average	100:147.2
Average loss in decumming	26.02 %
Average length of loose outer silk	740 m
Average standard of loose outer silk	2.861 legal deniers
Average elasticity of raw silk	220.15 mm
Average tenacity of raw silk	40.22 gr
Average standard of raw silk	10.42 deniers
Tenacity of raw silk, per denier	3.862 gr
Loss of raw silk in decumming	23.44 %
Loss of loose outer silk in decumming	21.13 %
Loose outer silk per 100 of silk	27.928 %
Ash of silk	0.809 %
Spinning of Silk, with 3 new cocoons or 4 mixed, with 4 ends—water temperature: in the basin: 60°C; in the beater: 95°C.—speed of divider: 125 meters per minute; turns of barrel in beater: 7; Yield (weight of cocoons necessary to yield 1 kg. of silk) on an average	9 kg.

Advice is given as to the technique of this rearing and the utilisation of the mulberry leaves for this purpose. It is advised to give leaves at

nest branches immediately after the second moult: to use for summer rearing those trees that have not been defoliated in spring and which have been touched by spring frosts but have formed new foliage; also those that are best for winter pruning; those to be rejuvenated by pruning, or as is more usual, by removing the interior leaves of the crown of those trees that had been used for spring rearing, or by defoliating one out of every three branches. The trees that have been partly defoliated in summer or autumn should be manured and freed from mosses, lichens, etc. In experiments made by the author it was shown that removing $\frac{1}{4}$ to $\frac{1}{2}$ of the foliage in summer causes no injury to the trees; moreover, it is an advantage, for air and light penetrate more easily into the less dense foliage.

o - On the Spawning Migration of the Lake Trout (*Salmo fario lacustris* L.). — RICHARD LOUIS, in *Comptes Rendus des Séances de l'Académie des Sciences*, 1916, Second Half-Year, Vol. 163, No 19, pp. 527-529, Paris, 1916.

The Author has extended his previous researches on the spawning migration of the salmon (*Salmo salar* L.) (1) so as to include other species. Lake trout rarely spawn in lakes themselves, but find their way up tributary streams. The author's observations bear on the lake trout of Lake Annecy and Lake Nantua, and were carried out in August 1916; those in Lake Nantua were the most characteristic. Lake Nantua has two principal tributaries: the Merloz, which the trout ascend for spawning, and the Doye, which presents no migration. The volume of dissolved oxygen in these waters was found to be:

In the Lake itself: 6.8 to 6.9 cc. in the superficial layers (temperature = 19.1° to 20.5° C.); 6.5 cc. at 10 m. deep. (temperature = 11.9° C).

In the Merloz: 7.4 cc. (temperature of 11.9° C).

In the Doye: 5.8 cc. (temperature of 12.2° C).

Thus the trout pass from a region poor in oxygen to a richer one. This fact may be of practical importance. In fact, the Administration of Waters and Forests has established a station on the Merloz in order to capture the breeding-fish at the time of their ascent and to carry out artificial fertilisation, so as to obtain eggs and fry for the purpose of restocking. This initiative deserves to be followed, by using the tributary containing the largest volume of dissolved oxygen, for in that tributary are found the most numerous and healthy breeding fish.

p - The Activity of Nitrogen-fixing Bacteria in Fish Ponds. — See No. 12 of this Bulletin.

FARM ENGINEERING.

A New Device to Increase the Power of Tractors. — *Le Génie rural*, Year 8, No. 64, pp. 3011, 2 fig. Paris, October 1916.

This device, designed by MM. MISTRAL and BROCHE has the object, with help of an aerohydraulic-transformer of mechanical couples, of using

(1) See B., May, 1916 No 543.

(Ed.)

internal-combustion engines of a power practically equal to the normal work to be done by the machine. For this purpose the "resistance" of the couple, practically equal to the "power" represented by the normal power of the motor, is divided into two groups: one represented by the mechanism serving to move the machine, the other by the mechanism or implements serv-

Device for increasing the power of tractors.

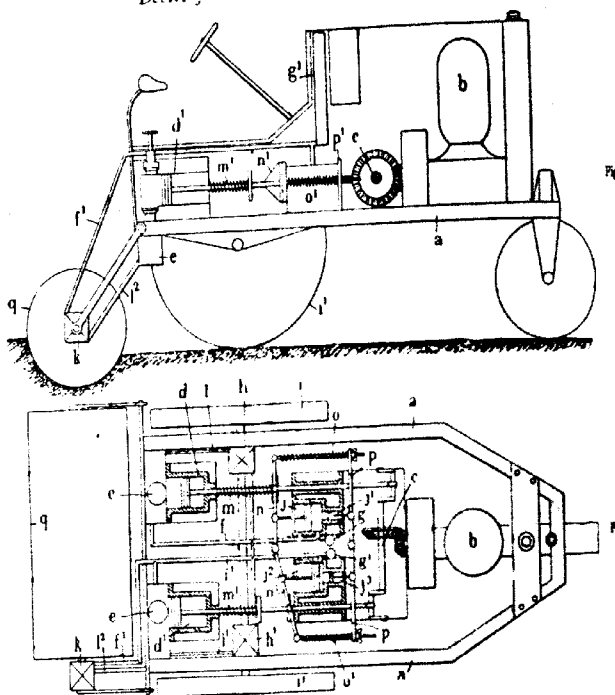


Fig. 1: Vertical section.

Fig. 2: Plan.

ing for the normal work of the same machine. These groups are in relation one with the other according to the work the machine has to do; if, for example the resistance to the implements diminishes, then the machine moves quicker, and inversely.

The diagrams given above shows the arrangement used: on the chassis *a* an internal combustion engine *b* actuates an elbow-shaft *c* control

ing the two pumps d and d^1 which draw water from a tank e to supply a pipe-system f and f^1 . The pipe-system f supplies the air chamber g and the hydraulic motor h which controls the wheel i of the machine, and also the differential regulator pistons j^1 and j^1 . The pipes f^1 also supply the air chamber g^1 and the hydraulic motor h^1 which controls the land wheel i^1 , as well as the differential regulator pistons j_2 and j_2 . The motors h and h^1 form part of the two "resistance" groups represented by the moving of the machine.

A third hydraulic motor k can be fed by one of the pumps d and d^1 on opening the right tap. In this case, the other pump only works the two motors h and h^1 serving to move the machine. The motor k controls the working parts (shares, harvester, transmission, etc.). The regulating device controls the large pistons j and j^1 connected with the levers n and n^1 which are fastened by adjustable springs o and o^1 to the axle on which the little differential pistons j_2 and j_2 are coupled.

When the working implement meets a sudden resistance, it causes increased pressure in the motor h controlling that implement and in the pipe system f in such a way that the corresponding piston j_2 acts on the lever n^1 to diminish the speed of the piston of the pump d^1 while the corresponding differential piston j_2 acts at the same time on the axle p to diminish the pressure in the other pipe-system f^1 so that the power of the motors h and h^1 serving to move the vehicle are decreased in power to that amount.

73- **A Simple Apparatus for Clearing Vines.** -- MOLINIS U., in *Le Progrès agricole et viticole*, Year 33, No. 47, pp. 499-500. Montpellier, November 19, 1916.

The writer recommends, for pulling up vines, the following machine which he has used to clear a large area, and which can be quickly and cheaply made: A pair of wheels, even if not very strong, are joined by an axle which projects beyond the hubs. On each side, an iron bar is fixed by its middle to the projecting end of the axle. The anterior part of the bar supports a wooden axle-tree rigid like the shaft to be fastened to it and suitable for harnessing two animals, oxen or mules. To help traction, the free part of the bar may have a counterpoise. Round pieces of wood are placed between alternate spokes, which gives a sort of latticed windlass, turning with the wheels. Then a strong piece of wood should be fixed across and one end of a chain about 30 feet long should be attached, the other end being held by a man following the apparatus and who entangles with it the head of each stump. The stump comes away, followed by the roots.

Grafted vines in strong land may break at the point of union: this could probably be avoided by placing an iron plate on the side of the stalk opposite to the direction of pull.

The driver and animals soon become accustomed to stopping and starting, and after a while can easily clear half a hectare in a day.

74- **Hay Sweep.** -- *The Implement and Machinery Review*, Vol. 12, No. 400, pp. 756-757, 3 figs. London, November 12, 1916.

Figure 1 shows the CARNE Hay sweep ready for transit. The apparatus has the advantage of having the land wheels fixed so as to give a good

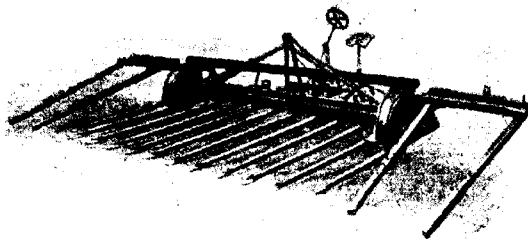


Fig. 1. — Carne's Hay sweep ready for work.



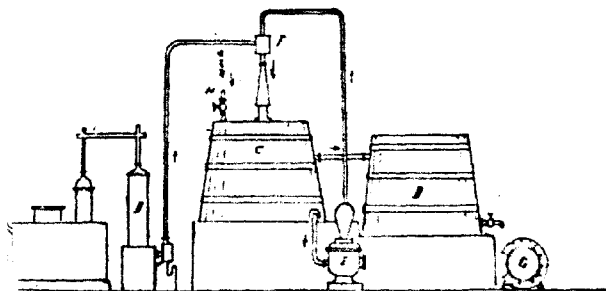
Fig. 2. — Carne's Hay sweep arranged for transit.

balance. They are housed on iron arms hinged on the end castings, so that the land wheels may be placed 14 in. in advance of the carrier bar, and inside the end tine. To prevent hay from clogging the wheels, they are guarded with sheet iron covers. The tines are operated by means of a worm and worm wheel, the shaft of which is placed near the drivers seat, and it is claimed that this gear will raise a 10 cwt. load and sustain it at any point. It is also adapted for carrying corn, since the tines are easily lifted clear of the ground. For transport, the CARNE hay sweep can be raised as shown in fig. 2.

25 - **Apparatus for Sulphuring Musts and Wines on a Large Scale by Sulphur Dioxide produced directly by Burning Sulphur.** — CIAPETTI G., in *Giornale Vinicolo Italiano*, Year 42, No. 45, pp. 784-786. Casale Monferrato, November 5, 1916.

An apparatus recently devised for sulphuring any quantity of must or wine by using sulphur dioxide produced directly by burning sulphur, instead of using liquid sulphur dioxide or metabisulphite.

The liquid to be sulphured (wine or must coming from the press, first filtered through a wire gauze with a 2 mm. mesh) is contained in a covered vat C, which is supplied as required by a pipe with the tap H and leading from a vat placed high up (not shown in the figure) which is filled by a pump.



Apparatus for sulphuring must and wine on a large scale.

The vat C is covered by a bronze mixer F communicating on one side with the furnace A where the sulphur is burnt, and on the other with a circulation and force pump E which pumps the liquid from the vat C; this liquid passes through the mixer and returns to the vat C carrying with it the sulphur dioxide sucked from the furnace; this operation continues until the liquid is sufficiently saturated, which can easily be ascertained by iodine test.

When the sulphuring is finished, the tap H is opened to fill the cask thus displacing the already saturated liquid which passes by an overflow into the vat D. From the latter, the sulphured wine or must is run off to barrels.

This apparatus gives regular and continuous sulphuration, and requires no attention other than feeding more sulphur into the furnace. It can be made in various sizes.

76 - A Simple Apparatus for Filtering Wine-lees. — *Giornale vinicolo Italiano*, 1916, Year, N° 48, p. 815, 1 Fig. Casale Monferrato, November 26, 1916.

This very simple filter, designed by D^r VANNUCCIO VANNUCCINI, is made up of: a barrel *T*, shaped like a truncated cone, 1.3 metres long with a diameter at the lower end *F* of 0.65 m. and at the upper end *F'* of 0.4 m. and a circular opening 0.22 m. in diameter in which can be placed a sown cloth sac 1.4 m. long and about 1.4 m. in circumference.

The empty sack is placed in the barrel: in its mouth which covers the circular opening of the barrel, the lees are poured till nearly full; the mouth



VANNUCCINI apparatus for filtering wine-lees.

of the sack is then tied with strong cord, sufficiently long to leave two free ends allowing of suspending the apparatus to the ceiling of the warehouse for some time.

The barrel, being heavy, tends to slip down over the sack; the latter also tends to gradually emerge through the circular upper opening, where it is thus pressed and the liquid is forced through the cloth into the barrel, whose weight, thus increasing gradually, also increases the pressure on the sack and also on the lees, which becomes more consistent in consistency and also is more resistant to the passage of the filtered fluid.

When filtration is finished, the wine is withdrawn, by means of a small hole placed in the lower part of the barrel.

- 7 - **A New Apparatus for the Distillation of Peat at a Low Temperature.** — *The Times Engineering Supplement*, 12th year, No. 505, p. 183, November 24, 1916.

Raw peat, when it is cut, contains up to 90 per cent of water. In the apparatus in question, after the formation of briquettes, the peat is first tried in a horizontal chamber through which passes a current of hot air and where the briquettes are continually in movement. During its passage through this chamber, which occupies 45-50 minutes, the water content of the peat is reduced to 20-25 per cent.

At the beginning of the operation, heat is supplied by means of producer-gas generated from an auxiliary apparatus working with air-dried peat, but after an hour or so, the gas evolved from the distillation of the peat is sufficient for all purposes.

As soon as the temperature of the retort approaches 100°C ., the gas and steam are drawn off at the upper part of the tube, passing into a condenser of special construction which takes the form of a series of shallow, inverted cones. At the top of the condenser, the hot vapours encounter a current of cooled gas, which deprives them of all watery particles.

The coal-tar oils are also condensed separately, while the non-condensable gases are used for combustion. It is important to note that the condensable oils are drawn off by a special apparatus, as soon as they are found in the retort. For working and briquetting the peat, 1 H. P. per ton of peat is required.

The yield of oil, of course, varied with the nature of the peat, and amounts to from 25 to 30 gall. per ton of dry peat.

After the extraction of the oily matters and tar, the charcoal remaining in the retort is withdrawn by an automatic process; it ranges from 30 to 33 per cent of the weight of the raw peat. It contains on an average: 11.82 per cent of volatile matter, 79.71 per cent of fixed carbon, and 8.47 per cent of ash.

In working up the water solution from the process, the yields per ton of peat treated were as follows: methylated spirit 2.56 gall., acetic acid 19 lb., ammonium sulphate 8.0 lb.

The process is equally applicable to lignite, wood, and many kinds of shale.

- 8 - **A Device for the Automatic Regulation of the Humidity of the Air.** — *Scientific American*, Year 72, No. 41, p. 355, New-York, October 14, 1916.

A device to regulate the moisture in the air of bakeries, leather factories and tobacco houses, cotton and various textile mills, where a constant humidity is required.

The device is electrically operated, automatically controlled and entirely self contained. It is mounted on the walls or columns of a room or suspended from the ceiling; besides, the control apparatus is provided with a deflector which is in the regulator chamber, and when atmospheric conditions require, the deflector turns a current of water which flows to the centre of a rapidly revolving disk *a*.

The water is thrown out by centrifugal force against the teeth of a copper grid at the circumference of the disk. Behind the disk is a fan



Device for the automatic regulation of the moisture in the air.

which forces out all particles that are sufficiently fine to float round the edge of the case.

79 -- Review of Patents.

Tillage Machines and Implements.

- Canada
- 170 845 -- 170 890 -- 171 583. Ploughs.
 - 170 846 -- 170 875. Landrollers.
 - 170 853. Knife combined with pulveriser for cutting weeds.
 - 170 896. Lubricating for ploughs.
 - 171 945. Agricultural Implement Drive Mechanism.
 - 171 198. Plough share.
 - 171 592. Agricultural Machine.
 - 171 605. Weeder and Cultivator.

- Denmark 21 539. Double balance plough.
21 582. Motor plough.
21 583. Device for motor plough.
- France 480 370. Device applicable to a motor plough or other machine provided with several shares.
480 425. Cultivators.
- Italy 154 649. Mechanism of motor plough.
155 423. Reversible ploughs for animal or mechanical traction.
- United Kingdom 8 554 — 8 685. Ploughs.
8 555. Motor plough.
- United States 1 194 166 — 1 194 668 — 1 200 106. Ploughs.
1 196 222. Wheel plough.
1 196 293. Gang plough.
1 196 472 — 1 196 606. Pulverisers.
1 196 540. Disk cultivator.
1 197 009. Motor plough.
1 197 415 — 1 198 846. Harrows.
1 198 571. Adjustable orchard plough.
1 198 912. Coulters.
1 199 095. Power operated mechanism for tractor ploughs.
1 199 329. Cultivator shovel.

Fertiliser Distributors.

- France 480 509. Process for improving the productivity of the soil by using iron titanate or ferro-titanic sand.
480 569. New process for making compound manures.
- United States 1 194 358. Spraying apparatus.
1 195 879. Fertiliser distributor.
1 197 292. Combined seeder and guano distributor.
1 198 900. Proportioning Drum for mixing fertiliser material.
1 199 417. Manure spreader.

Drills and Sowing Machines.

- Canada 170 862. Process for coating seed with fertiliser.
- United States 1 193 501. Planter.
1 198 928. Potato planter.

Control of Diseases and Pests of Plants.

- United States 1 194 358. Sprayer.

Reapers, Mowers and Harvesting Machines.

- U.S.A. 170 950 — 170 952. Binders.
170 951 — 171 183. Shocker.
171 673. Grain Binder mechanism.
154 597. Improvements in mowers.
- United Kingdom 9 978. Harvesting machine.

Machines for Lifting Root Crops.

- U.S.A. 480 350. Potato lifting machine.
- United Kingdom 10 379. Harvester for potatoes and the like.
- United States 1 193 746. Peanut Harvester.
1 194 359. Machine for topping beets.
1 195 561. Machine for harvesting Potatoes.
1 198 985. Beet harvester.

Threshing and Winnowing Machines

- United Kingdom 8 416. Threshing Machine.
10 258. Seed separator.
United States 1 200 253. Threshing machine feeder.

Machines and Implements for the preparation and storage of grain, fodder, etc.

- Italy 153 622. Low and high temperature drier for cereals, cocoons, etc.
154 708. Drier with horizontal superimposed shelves and movable racks for maize, etc.
154 784. Improvements in straw elevators and the like.
United States 1 195 479. Feed for baling machines.
1 196 126. Baling press.
1 196 247. Hay loader.
1 199 579. Hay cocker.
1 200 280. Mounting for silo floor.
1 200 330. Silo roof.

Steering, etc. of agricultural machinery.

- United States 1 195 341. Steering means for tractors.
1 195 373. Automatic adjusting mechanism for tractor guides.
1 194 269 — 1 194 738 — 1 196 507 — 1 198 445 — 1 198 494 — 1 198 849 —
1 201 432. Tractors.
1 198 444. Mower tractor.

Feeding.

- Canada 170 716. Calf weaner.
United Kingdom 8 251. Shredder for vegetables.
10 264. Food for animals.

Apiculture.

- Canada 171 530. Bee smoking device.

Aviculture.

- Canada 171 259. Egg preserving method.
United Kingdom 9 802. Hatching appliances.

Fish-breeding.

- United Kingdom 10 817. Fishing nets.
10 827. Fish traps.

Industries depending on plant products.

- Canada 171 393. Peanut butter grinder.
171 630. Rubber preserving compound made of cocoa butter, castor oil and gasoline.
Italy 150 576. Apparatus for the rapid aceticification of wine, cider, beer and alcohol.
152 670. Apparatus for dehydrating fruits and pulses.
153 598. Machine for the simultaneous extraction of the essence and juice from citrons, bergamot oranges, oranges and mandarins.
154 376. New GIACCHETTI process for preserving bread made from wheat and other cereals for human consumption.

- Netherlands 1 431. Method and device for collecting the juice from sugar cane and other sacchariferous plants.
- United Kingdom 10 382. Fumigation chamber for coagulating latex, and containing a series of inclined planes.

Dairying Machines and Implements.

- Canada 170 878. Milking machine.
- 171 108. Pasteurizer.
- Denmark 21 507. Combined Pasteurizer and Regenerator.
- France 480 450. Milking Machine.
- United Kingdom 9 776. Cream separator and churner.
- 11 192. Milking Machine.

Various.

- Denmark 21 571. Peat press.
- United Kingdom 8 415. Refrigerator.
- 10 253. Bottle washing machine.

The Ventilation of Farm Buildings. — I. CRISDALE (Director, Dominion Experimental Farms) and ARCHIBALD E. S. in *Dominion of Canada, Department of Agriculture, Dominion Experimental Farms Bulletin* No. 78, pp. 32, fig. Ottawa, May 1914. — II. *The Agricultural Gazette of Canada*, Vol. 3, pp. 508-600, fig. Ottawa, July 1916. — III. THURMAN J. M., the King System of Ventilation, *Ibid.*, pp. 615-618, fig.

After some general considerations, the different causes of failure in the installations are defined, such as the choice of an unsuitable system, want of space, attention, etc. An important point is to prevent water condensing on the interior walls of the buildings by covering them with wooden linings.

Cubic feet of air per cow. — The number of cattle must be considered: so many cattle makes it difficult to ventilate without draughts, while a few makes it difficult to avoid a low temperature and at the same time to ventilate well. 600 to 800 cubic feet of air space should be allowed for each cow two years old and over.

The ventilation of shippens, stables, and piggeries is discussed and the results of experience and observation are given.

A. VENTILATION OF SHIPPENS.

RUTHERFORD system. — This system has been shown to be the most simple to work, and is easy to install in old or new buildings, while it is adaptable to all classes of stables, suitable for different climates, and effective in controlling the temperature in all parts of the stable.

Installation of the Rutherford system in a stable for 24 cattle:

Fresh air inlet: at soil level, on the left hand side by direct passage, the right by a U shaped passage, covered externally by a small roof.

Foul air outlet: by one or two shafts projecting above the roof covered with a cowl, and regulated by a valve. In another type, the outlet shaft emerges at the side of the building, above the middle of each row of animals for a better effect.

The U shaped inlets are very useful; the outer arm should be made higher than the interior arm in countries with much snow.

MR TRUEMAN observes that the cold air entering on the soil level chills it and also the lower layers of air in the shippoon, which is a disadvantage in cold winters. Further, he says that the RUTHERFORD system provides the purest air for the animals in medium size buildings, but that the cold air chills the animals when the outlet shafts are closed and ventilation ceases.

The KING System which has many admirers and with which many have succeeded, is remarkable for the fact that the foul air is drawn from the floor and the fresh air enters at the ceiling. The advocates of this system

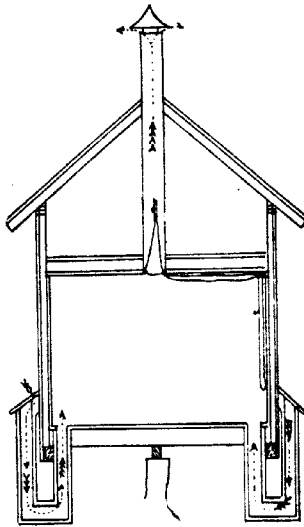


Fig. 1. — RUTHERFORD Ventilation System.

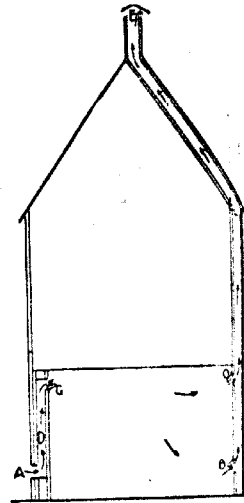


Fig. 2. — KING Ventilation System.

claim that since the chief impurity is carbonic acid gas which is heavier than pure air, the outlets for impure air should begin near the floor level. On the other hand, it cannot be easily applied to all shippoons, as it requires a large number of ventilating shafts. Again, the insulation of the walls has to be done very carefully, for the impure air descending to the soil may condense moisture on them.

MR TRUEMAN quotes, in favour of the KING system, the fact that provides plenty of pure air in medium sized buildings. The air warmed

animals rises up and mixing with the fresh air, raises its temperature a suitable degree without vitiating it.

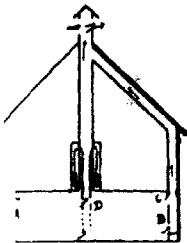
The vertical section shown in fig. 2 shows the path of a current of air going from A to C and which reaches the roof, then the opposite wall, and escapes by two openings in the outlet shaft, one below, the other above.

In the pierced walls system, there are ventilating holes near the ceiling in the walls exposed to the air. The openings should be 4 ins. in diameter at 3-foot intervals which gives 30 to 36 openings in a standard shippon.

There is no regulating system.

The *Convection* system depends upon convection due to the heat from animals causing displacement of the lower air which, when warmed, will

KING System : Types of outlet shaft.



— Central shaft, and lateral shaft following the roof.

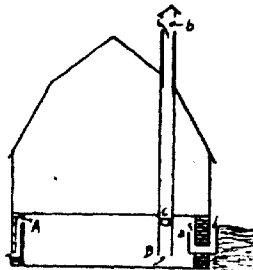


Fig. 4. — Eccentric outlet shaft.

and be replaced by cool air entering by two windows in the opposite

If only a single shaft is used, it should be 2 feet square.

If two are used, each should be about 1.5 feet square, one in the centre of the building and the other to one side but joined to the first by a shaft running parallel to the roof. The shafts should be 2 or 3 feet higher than the roof and provided with a cowl and a regulating valve. At the barn floor the central shaft has a door to allow of hay or straw being thrown down in the shippon.

In the system "E" which is a modification of the KING system, the ventilating shafts are placed entirely inside the building. For 20 cattle there should be 6 shafts, each 12 inches by 6 inches in section, and 3 shafts on each side. Trap doors can be added for regulating the air. It works and costs \$12 for a shippon of 22 cattle.

B. VENTILATION OF STABLES.

In 1906 on the Central Experimental Farm, a stable for 23 horses was

The ventilating system was a combination of the KING and RUTHERFORD systems. The air enters by the left side close to the soil, passes by

an underground pipe opening in the centre of the stable, while on the right side, the air enters low down, passes towards the ceiling, then goes out low down at the left side, and by a central shaft. These two systems, though installed in the same stable, can work independently of one another.

The RUTHERFORD system gave the best results by removing the humid and vitiated air from the stable.

C — VENTILATION OF PIGGERIES

This question presents no difficulty save for young fall pigs which require an ample supply of fresh air without lowering the temperature in duly.

Ventilating shaft with double isolating walls for the exit of impure air.

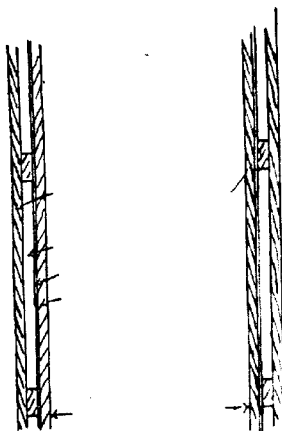


Fig. 5. — Vertical Section.

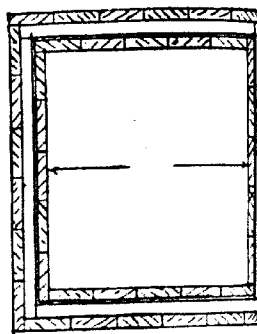


Fig. 6. — Horizontal Section.

To gain some information on this subject, 2 single pen piggeries were built on the experimental farm and ventilated with modified and ordinary KING and RUTHERFORD systems :

EXPERIMENT I.

Pen No 1 : KING system combined with central shaft and regulating valve (RUTHERFORD).

Pen No 2 : Air enters on RUTHERFORD system ; exit at opposite side regulating valve ; no central chimney ; shaft opening on the roof.

EXPERIMENT II.

Pen No 1 : Air enters on RUTHERFORD system ; exit by central shaft with valve.

Pen No 2 : Air enters on RUTHERFORD system : exit on opposite side

EXPERIMENT III.

Pen No 1 : Air enters low down on left side ; exit on same side and by central shaft ; no valve.

Pen No 2 : Air enters high up below ceiling ; exit on opposite side and the shaft opening on roof.

EXPERIMENT IV.

Pen No 1 : Air enters low down on left side ; exit on same side below ceiling ; central shaft without valve ; escape by opposite side and from the raft following the slope of the roof.

Pen No 2 : Air enters on RUTHERFORD system ; exit on opposite side high up.

RESULTS. The RUTHERFORD system has been adopted for a large model piggery. In the provinces of Quebec and Saskatchewan, this system has been adopted as it gave the most conclusive results.

- **Arrangement for Securing the Safety of Horses in Case of Fire.** — *Scientific American*, Vol. CXXV, No. 15, pp. 426 and 335, New-York, October 7, 1916.

A device used in a stable in Los Angeles (U. S. A.), composed of ordinary stalls, provided with mangers and racks ; the end of the stall by the horses head is closed by a door so mounted that it opens by its own weight soon as the holding bolts are withdrawn. The bolts are controlled by a running along the wall of the stable and which has easily fusible plugs placed at equal distances apart. If fire occurs anywhere, the plugs melt, the bolts and the door of each stall automatically opens. At the same time a door closes at the entrance to the stall, preventing the animal from running into the stable. In addition, the mangers fall automatically, thus ringing the halter ; the noise caused by the opening and closing of the doors and the fall of the mangers, is sufficient to frighten the horses which, as has been shown by experiment, quickly escape by the outlet that opens in front of them.

- **A Portable Sheep Shelter on a Farm in Central New-York.** — *The American Agriculturist*, Vol. 18, No. 16, p. 8, New-York, October 14, 1916.

This comparatively cheap apparatus protects the sheep from the hot sun in summer and serves as a shelter for the sheep to huddle together on cold nights in spring and autumn. It consists of a 4 sided roof mounted on road-tired wheels, which enable it to be easily moved about.

RURAL ECONOMICS.

- **The Method of Valuation of Real Estate.** — **SERGII ABBIGO**, in *Annali dell'Istituto Nazionale di Scienze Forestali*, Florence, Vol. 1, pp. 83-131, Florence, 1916.

Certain questions of forest valuation, which recently caused much discussion (choice of rate of capitalisation, choice of rotation, etc) on rural valuation, following on the publication of a German treatise by FRIE-

DRICH AERBOE (1), which differences could probably have been adjusted by the general principles of economic science. The work is divided in 2 parts, the first of which methodically considers the general principles of valuation that are applicable to any economic question and bearing on the most controversial points in rural and forest valuations. Limitations of space in the first volume of the Review in which the article is included have only allowed the publication of the first part of the work. under the title: *Contribution to a general theory of valuation and the methods of valuation*. Thus, the first part only is dealt with, and the summary of the principles of the question is given below.

All real estate, a) material objects, b) services, c) property rights according to FISHER's (2) subdivision (adopted by the writer), may be valued. An expert may value land (class a) or may estimate the rent due from such land (class b) or, again, a right held over the land as in a long lease), and which constitutes the right to obtain a part of the services and revenues yielded by the land (class c).

Belonging to the first class (material estate) may be distinguished: *consumable property, auxiliary or productive property*, and also *temporary and durable property*. For valuation, the distinction between temporary and durable property is important, for while the value and service of the former cannot be estimated, the latter can well be valued.

The valuation of an economic property means the determination of the amount of money than can be considered as equivalent to the property. This value not only can, but *must*, vary according to the aim of the valuation, and the aim gives the key for the correct solution of any problem of valuation. The aims of a valuation can be, even if not explicitly stated, understood in only one way by the interested parties; if this is not so, the aim must be clearly defined.

Many controversies on the method of valuation have been caused by the aim being insufficiently precise, but often the expert has not to define it, as it is a juridical or economic problem. Such is, for example, the valuation of improvements to land, when the aim is to fix the compensation due to the tenant who has carried out the improvements. The amount of compensation or the criterion for the valuation may be defined in the contract, and then the expert has only to apply them as defined in such contract. If not mentioned, they would be applied, according to the custom of the country, and then the expert should keep to the usual method.

If no customs or laws exist as necessary premises for the work of the expert, their existence should be assumed. In such a case the necessary criteria for such an assumption can only come from economics and law, not from estimation.

The various criteria chosen according to the aim of the valuation may lead to estimation either on the basis of *the buying or selling price*; *the mar-*

(1) See AERBOE DR FRIEDRICH: *Die Valuation von Landgütern und Grundstücken* 1 vol., 542 pp. 52 plates. Parey, Berlin, 1912.

(2) See IRVING FISHER: *The Nature of Capital and Income*. London, Macmillan, 1906.

ket price; the cost price; or on the basis of the capitalisation of the revenues. In certain fairly common cases the criterion may be of substitutions, or again the price of transformation, as, for example, when it is to be decided whether it is more profitable to sell forage directly or rather indirectly as meat, milk, etc.

Valuation on the basis of the buying and selling price is the most common, and in speaking broadly of the *estimated value*, the probable market price is most often meant. With a certain period and market, the prices are fixed according to the supply and demand. This fact must be appreciated by the valuer, though this criterion is not applicable to every valuation. If the unsaleable deadstock of a farm is to be valued, this criterion of no value, as no market exists (1).

If the injury due to destroying a coppice has to be estimated the criterion to be used in such a case is the capitalisation of the revenue lost. On the other hand, the sale price of the mass of wood has to be fixed, the market price must be considered and the result may be quite different. It is not a case of two values, but of two different criteria decided by the aim of the valuation. In the valuation of agricultural real estate, the presumable buying or selling price is not always required. In dividing successions, for example, the dominating factor is the equality of incomes, and certain recent laws, as in Switzerland, even enforce it. The value to be given to the real-estate forming part of the patrimony to be divided is that obtained on capitalising the revenues and not the market value in case the two do not agree. In estimating on the basis of the selling or buying price, the two must be separated when the estate to be valued is remote from the market as expensive carriage may completely alter the case.

Valuation on the basis of cost price requires some explanation as to the meaning of *cost*. In practice, *cost* means the total expense necessary to obtain some given economic estate. But as the condition of the person bearing the cost may vary, as well as the means used to obtain the estate in question, several kinds of *cost* must be distinguished. In general, when speaking of *cost*, one refers to the *producer* and indicates the total cost of production. In this way, the calculation of the cost of production refers to the manager considered as distinct from the capitalist and worker (manual or intellectual). The manager is considered as buying on the market all necessary means of production, whether material things or services. Capital is included among the services and its price is interest; and the men's work, whose price includes salaries, etc.; the services rendered by public institutions the price of which is fixed by the laws of production. These are the buying prices, which, in their totality by the share required for paying off, constitute the *cost of production*.

This concept of the cost may also apply to a manager having certain elements necessary for production. The cost of these elements is

(1) See *SEMPER A: Trattato ad alcune più controverse valutazioni agrarie*. Conegliano, tipografia, 1906.

thus represented not by the buying price, but by the income given up by the contractor and which he could have obtained. Again, the cost varies as the position of the contractor, and that varies with time, as the prices are variable.

A farm producing various substances can not have a cost for each product, but a general cost of the collected products. The cost of a product, as understood in ordinary language, is in reality only the proportional cost of a part of the whole. A simple method of fixing the proportion is to subtract the sale price of all the products less one from the cost of the whole and to consider the remainder as the cost of the one product. The producer who wishes to find the cost of his products separately, in order to have some rule for fixing the individual sale price, finds it convenient to apply to each article its *specific* expenses and to divide the other general expenses in varying proportions according to the nature of the article. Other methods might be used, according to the object, but it is necessary to include the *analytical accounts of cultivation and the proportional division of the general cost with the price of products on the market*.

In many cases of valuation on the basis of the market price, the calculation of the *supplementary cost* is required, which differs from the preceding and is present each time that the successive unit cost of the product obtained by a contractor is unequal to the previous ones, but increases or decreases in relation to them.

In this case the method of division is no longer static but dynamic as regards the variation of the cost in changing position. This conception of the supplementary cost can be equally applied, in considering a number of products, to a new product, different from previous ones, and which then increases the cost and may be different from that borne on this head by anyone producing the same thing under other conditions. It can also be applied to new products replacing previous ones, such as a crop replacing another in a rotation, so as to include, in the increased cost price, the lost sale price, that would have been realised by the product now replaced by another.

After considering this concept of cost, the Author shows that, in many valuations, their aim necessitates close reference to the criterion of cost and to one or other of its practical applications. Controversies bearing on inventory valuations only exist when the aim of the inventory is not clear, as it can be varied and at the same time legitimate. Valuation based on capitalisation of the revenues is considered by many as the only rational method of valuation, which is obviously erroneous, for, above all, it is not applicable to all economic estate, but only to economically durable estates, which yield services having a clear and distinct price, or to property rights in the second case, because in many cases the aim of valuation requires different criteria and consequently different methods.

Nevertheless, the criterion of capitalising revenues is one of the most important and also the one most often used. It is applied by summing all the revenues accruing from the estate under consideration, after having discounted them at the time of valuation at a rate fixed by the rules of com-

round interest as shown by financial calculations. Therefore this method of valuation implies a forecast of the revenues that will be yielded by the estate in question, that is to say that it implies the anticipation of the importance of its useful prestation, the advantages it will produce, and their valuation; in addition, the choice of the rate of discount (or of capitalisation).

The exact interpretation of the result of the valuation is not possible the criterion used for the valuation of the revenues and the choice of the rate is not known. But, if known, it is a fundamental point for reference and an excellent guide for suitably placing an investment, as well as for buying or selling some durable economic estate. If the estimation of the revenue is required, the choice of the rate of capitalisation is practically indifferent. Whatever rate may be adopted, the interpretation expressed more highly is always correct. The rate may be given to the estimator when asking the price to pay for a certain estate and when a *fixed revenue* is desired from the investment. But the valuer may also choose the rate as well as forecast the revenues, as when it is required to know the relative advantage of investing in a given estate in comparison with other estates showing possibilities for investment. In this case, the terms of comparison must be chosen or one or several possible investments at that time and that market, and of which the annual unit income is known. But the expert can provide other important elements of judgment besides forecasting the revenues, and he can consider them together when proposing the rate of capitalisation. The elements refer particularly to the *risk* and constitute the *coefficient of probability* relating to anticipated revenues. The criterion of estimation for capitalising the revenues may have many applications on this head, but the value of capitalisation obtained should always be interpreted and employed within the limits of the indicated aims. It is obviously wrong to confuse the value of capitalisation which solely relates to certain clear aims of the estimation, with the market price, or again, to consider the latter as *exact, real, etc.* the former on the contrary, as unjust and arbitrary.

Having established that the choice of the method of estimation should not certainly be considered with the criterion of valuation, to be applied, in agreement with the aim of the valuation, to some of the criteria of valuation like those of cost and capitalisation of the revenues, there can be no doubt as to the choice of the method, which is plainly manifest in the determination of the criterion of valuation. On the other hand, if this cannot be assumed, the criterion of the market price is applied to the estimation. Here, there are several possible methods, which must be realised in order to choose the most suitable, for in applying each of these methods, certain conditions must be fulfilled to obtain good results.

The writer carefully examines these methods and deduces the relations between the market price and the values found by applying other criteria of valuation. He divides the various *methods* of finding the market price of any estate in the following manner:

- A — Synthetic estimation (direct).
- B — Analytic estimation (by capitalisation).
- 1) By capitalising at the average rate of the investment under consideration
 - a) with synthetic estimation of the revenues.
- 2) By capitalising at the rate of other investments considered as analogous.
 - a) with synthetic estimation of the revenues.
 - b) with analytic estimation of the revenues.

All these methods cannot be applied to all economic estates. Only the estates of durable utility and which give *productive services* allow them (as, for instance, land), but according to circumstances and not all with equal facility.

If it is required to fix the market price of present material property (food, fuel, seed, etc.), the *synthetic method* is the only one that is applicable but, to apply it, the property must be able to be compared with a type so that the prices quoted in a number of exchanges may be known, having all been at a sufficiently close time to that of estimation to prevent the conditions of demand and supply from changing too much; and over a sufficiently limited area to allow of agreement, even if approximable to the abstract conception of the economic market. For immediately utilisable material property, the previously discussed conditions often occur sufficiently, and, in consequence, the method allows of sufficiently accurate estimations: it is therefore, in these limits, a rational application.

The same may be said of the services yielded by consumable property or useful prestations withdrawn from the consumable estate and of which they form the revenue. There appears to be no other method applicable to them save the *synthetic method* which allows more or less accurate estimations according as the conditions (considered above) are present in a greater or less degree. Such would be, for example, the estimation of a rent to be yielded by a dwelling-house.

This exclusive applicability of synthetic estimation to finding the market price of immediately utilisable materials and the services from consumable property is attenuated, according to the author, in considering the value rendered by the knowledge of the cost of production. To this end, the writer examines the relationship between the *cost of production* and the *equilibrium price*, and finds that, in order to follow up the estimation with the hope of obtaining results not too far from the truth, certain conditions should be present that do not equally belong to every case, and which also should be considered each separately. The *process of ordinary production* followed by most manufactures of the materials to be valued at that time and on the market determined, and which is the basis of the calculation, should be determinable in an objective way without allowing too much freedom to the estimator.

It must be possible to fix a price for the contractor for all the material and service required for production, including the payment for the usual activity of the management, which is expressed in the ordinary process mentioned above.

In approximating the calculation of the cost of production with m-

or less productive technical methods than the usual ones, in including in the expenses the payment for the usual acumen of the management there would be a positive or negative difference representing the positive or negative retribution of the particular aptitude above or below the normal and possessed by the organiser or director of the business or estate. In this sense, more or less costly methods might be suggested; producers being dear or cheap as long as the payment for an ordinary ability is included in the cost; and, in practice, it would be impossible to do otherwise, for there is not a sufficiently extensive market for *able direction* which can allow the recognition of the different values of varied ability of management, that is to say of the various technical methods applied. In the abstract sense in including the price of this clever management in the calculation according to the measure desired, the same cost would always be obtained, no matter what technical method was to be considered for application.

The verification of the market price of some estate based on the determination of the costs of production is a rarely used method, for all the required conditions are not always present. When they are present, it is often for goods to which other methods of estimation, especially the *synthetic method*, are more accurately and rapidly applied. This method is more suitable for auxiliary use as a control of other methods.

The synthetic method of estimation is not applicable when it is the case of partial ownership, which may be bought or sold and can have a price, as in the case of direct control of land held on a long lease. The intangibility of the object to be estimated excludes it. Buying and selling such a right means nothing more than buying and selling series of services, prestations of revenues, and by it is meant the algebraic sum of positive and negative revenues. The only possible way of estimation is to deduce the price of the right to be valued from the price of the services rendered by the right. This is the substance of the *analytical* method as opposed to the *synthetic* method. It must be ascertained if estimation on the basis of the capitalisation of the revenues can also help to find the market price. According to the Author, the question, is really the choice of the rate of capitalisation.

The necessity is shown of clearly distinguishing the interest (i) of the capital (by capital is meant some economic estate producing revenues successively during time) from the rate (r) of interest or the cost of using the saving, for keeping these concepts of (i) and (r) distinct serves to explain many practical questions of estimation which are most controversial. There can be two ways of capitalisation, one based on the rate of interest on the capital in question (i) and one based on the rate relative to other forms of investment such that the rate may be considered as equal to that required. In the first case the prices actually realised and the corresponding revenues on a sufficient number of exchanges at the same time and relating to similar examples of the estate in question. Comparison between the price of the capital and the income gives the idea of the *mean rate of interest* of the investment considered at that time on the market. In the second case, to be able to consider the above mentioned equality as existing, the condition must be ful-

filled of knowing that the two investments under discussion (the one being valued and that used for comparison) are in mutual agreement and equal regarding all circumstances of safety, duration, etc., that are taken into account. Often recourse is had to the knowledge of the relative rate of the best investment negotiable at the exchange, but before using this rate for capitalising other investments, it must be remembered that it is only legitimate when the latter and the investment agree as to equal safety, duration, etc. Here lies the difficulty of this delicate method of investigation.

Synthetic estimation can be applied to *productive services* as well as to services rendered by consumable property; thus the rent (price for using the land) due for some stated real-estate may be estimated synthetically. But productive services differ from consumable property because, on account of their use in production, another method is applicable to them.

On account of their use in production, given that, for economic property, in producing which competition is active, the average price of a product P (round which the real prices oscillate) is equal to its cost of production K , the price of a given service K_1 which forms part of the cost of production, may be estimated; for, if $P = K$, then $K_1 = P - K_2$, or $K_2 = K - K_1$. This method of estimation would be applicable with good results when the desired conditions are present, and the manner of relationship to the knowledge of the price of an estate on the market will be noted, taking as bases the determination of the cost of production, and the result of the estimation will be more approximately accurate as the value of K_1 is greater compared with that of K .

The method of estimation suitable for *material estate of durable utility* is in the first place the synthetic method under conditions and following the modalities relating to material estate of immediate utility, over and above the application and the possible help of the determination of the cost of production in estimating them. But there is a difference between material estates of immediate utility and estates of durable utility, which is that the latter may conform to the method of analytic investigation, for useful prestations obtained from these estates are themselves the object of exchange on the market, and thus have a price. The price of material estate is the cost of the right to obtain these prestations and revenues. The question is, therefore, that of *capitalising the revenues*. This capitalisation can be made, either by means of the mean rate of interest on the capital under consideration, or by the rate of other investments considered to be similar according to the conditions previously mentioned.

The price of useful prestations or services that can be yielded by this estate can be fixed, either by the synthetic method, or also, if they are *productive services*, by the analytic method, by means of the analysis of the results produced according to the formula $K_1 = P - K_2$.

The method A, described above as *synthetic*, is also described as the *direct* or *empirical* method, while the method B, described above as analytic, is named *rational* by other writers.

The distinctions $\alpha - b$ and $\alpha - \beta$ do not give occasion for the use of different names by other writers on the subject. The distinction $\alpha - \beta$ is gene-

rally unnoticed; the distinction *a-b* finds its counterpart in the distinction made by other writers on Rural Valuation between analytical (or rational) estimation based on the lease (and on the profit sharing system), or based on the administration of the owner.

Other methods of estimation are given by various authors. One, very commonly mentioned, is the *comparative* or *indirect*, or *relative* method of estimation, which is characterised by being founded on a comparison of the estate to be valued with other similar estates. But the writer does not think that this method can be considered as different, as the *synthetic* method is always necessarily founded on a comparison. When an expert expresses the capital value of an estate synthetically even if more or less knowingly, he makes nothing but a comparison between the estate to be valued and other similar estates, whose *qualities* and prices are known to him. The method called *comparative* or *indirect* consists in the comparison referring explicitly to a given type-estate.

84 - **The Method of Determining the Cost of Production of Agricultural Products.** — MARENGHI E., in *L'Italia agricola*, Year 53, No. 8, pp. 337-338, Piacenza, 1916.

1) If on every farm it was only attempted to obtain a single product: wheat, or milk, or beef, etc., it would be quite easy to find the cost of production. In fact, it would be sufficient to divide the total average annual expenses by the quantity of the product obtained. But, with rare exceptions, the agricultural holding gives very diverse products at the same time. In this case, if a single unity of culture is observed, the total cost of production may be brought forward, but not that of each of the products.

2) To solve this problem, recourse is often had to a system of analytical accounts, but the method is too crude and inaccurate to give trustworthy results.

3) The writer is of opinion that the problem may be solved by keeping statistics for a number of similar farms from the standpoint of economic organisation. The information required for this purpose is:

- a) the quality and quantity of each product obtained on the farm.
- b) The average annual total cost of production. In expressing by: q_a, q_b, \dots the quantities of the products, a, b, \dots obtained on the average in each year in any one of the farms under observation; by x_a, x_b, \dots the cost (unknown) of production relating to it; by S the total expenses, the receipts and expenses should be equal, it would give:

$$q_a x_a + q_b x_b + \dots = S.$$

but if there are n farms being observed, where n is greater than the number of unknown ones, there would be a series of equations:

$$q_{1a} x_a + q_{1b} x_b + \dots = S_1$$

$$\dots \dots \dots$$

$$q_{2a} x_a + q_{2b} x_b + \dots = S_2$$

$$q_{na} x_a + q_{nb} x_b + \dots = S_n$$

From this system it is easy to obtain, by using the method of least squares, the average or most probable values of x_a, x_b, \dots which should satisfactorily solve the problem.

This method eliminates all the difficulties met with in establishing the crop accounts, for no arbitrary discrimination of the titles of expenses is required. These, as a whole, include: *Real or presumed leasing price of the real estate — interest on deadstock or livestock — reintegration of the capital — amount of raw material bought outside the farm — expenses for staff (labour, direction, administration, etc.) — taxes.*

The valuation of the labour is somewhat difficult on small farms worked directly by the farmer. But if the cost of production of any particular commodity is required, groups of farms must be chosen that produce mostly for the market and which for that reason are worked in another way.

If the cost of production of wheat is wanted, a number of varying farms should be chosen from varying districts. If, on the other hand, the work includes hills and mountains where the farms have a clear domestic value, then if the owner's work be valued at a normal price, the cost of production will be found to be much higher.

But for the agriculturist who consumes most of his products on his own farm, the idea of the cost is of much less practical importance, because he does not know it or only vaguely. This contradicts the economic law that affirms that, under free competition, the price of the goods is close to the maximum cost. As this is not so, it does not correspond to the truth, just as for similar causes, the laws of rational mechanics do not correspond to the real laws of the physical world.

The writer is collecting information to determine, among other things, the cost of production of grapes in the region of Piacenza, and proposes to return to this subject, dealing with it comparatively and in detail, if these researches lead to sufficiently accurate results.

AGRICULTURAL INDUSTRIES.

85 — *A Contribution to the Study of the Yeasts of Wine.* — KAISER E., in *Revue de chimie*, Year 23, Vol. XLV, No. 1158, pp. 149-155; No. 1159, pp. 165-170. Paris, September 1916.

The use of sterile media inoculated with chosen yeasts has shown that certain races are very sensitive to the food-composition of the medium to its richness in sugar, acids, or nitrogenous matter. The present work was undertaken to find how the nature of the nitrogen affects the fermentation of ethers. The nitrogen was given as ammonium sulphate, asparagin and monobasic phosphate of ammonia. In the last salt both phosphorus and nitrogen are obviously effective, and powerfully stimulate the action of the yeasts as well as zymatic fermentation.

The must used was composed of $\frac{2}{3}$ Touraine must and $\frac{1}{2}$ Burgundy must; so as to show better the effect of adding nitrogen as compared with the flasks having received none, the must was diluted at the rate of 12.

res of must per 6 litres of water. The composition of the must was as follows.

Composition of must per litre.

Total acidity of control sample (as tartaric acid) . . .	4.92	grm
" " " phosphated control (as tartaric acid) . . .	10.96	"
Volatile Acid (as acetic acid)	0.112	"
Sugar	129.600	"
Total Nitrogen	0.213	"
Ammonia	0.0626	"

In series A the must alone (control) was used, or the previously mentioned nitrogen compounds were added at the rate of 1 % reckoned as nitrogen. The must was inoculated with the following yeasts obtained from the National Agronomic Institute Fermentation Laboratory: yeast 7 (Saint-Emilion), 32 (Langlade, Gard), 88 (Chambertin), 94 (Musigny) and 255 (pointed Burgundy yeast). The following relations were calculated: R (fixed acids : fixed ethers), the two terms being expressed in tartaric acid; R' (volatile acids : volatile ethers), the two terms being expressed in neutral ethyl tartrate. The results of the experiments are given in series II and III; the fermentation temperature being 26° C., at which temperature the flasks were kept for 20 days, though the fermentation was usually finished in 10 days, and then they were left for 12 to 15 days at air temperature before being analysed.

TABLE I. -- *Composition of the wine obtained with yeast 32.*

	Control	Sulphate	Phosphate	Asparagine
Alcohol	5.7	5.7	5.4	5.04
Total Acidity	5.140 grm	6.070 grm	13.460 grm	6.190 grm
Total Acids	4.980 "	5.810 "	12.950 "	5.510 "
Total Ethers	0.809 "	1.000 "	2.792 "	2.307 "
Fixed acids : fixed ethers	8.4	7.9	6.3	3.2
Total Acids	0.124 grm	0.214 grm	0.405 grm	0.542 grm
Total Ethers	0.072 "	0.057 "	0.093 "	0.090 "
Volatile acids : volatile ethers	1.5	3.5	6.5	15.9
Fixed ethers : volatile ethers	9.6	14.9	25.6	38.9
Fixed ethers, per cent	90.6 %	93.7 %	96.3 %	97.5 %
Volatile ethers, per cent	9.4 %	6.3 %	3.7 %	2.5 %

TABLE II. — *Composition of the wine obtained with yeast 88.*

	Control	Sulphate	Phosphate	Asparagine
Alcohol	6°	5°4	5°2	6°
Total acidity	5.520 grm	5.520 grm	12.350 grm	5.970 grm
Fixed acids	5.190 "	5.260 "	12.080 "	5.410 "
Fixed ethers	1.331 "	1.307 "	2.235 "	2.443 "
R (Fixed acids: fixed ethers)	5.3	5.7	7.4	8.0
Volatile acids	0.263 grm	0.268 grm	0.241 grm	0.449 grm
Volatile ethers	0.057 "	0.042 "	0.071 "	0.071 "
R' (volatile acids: Volatile ethers)	6.7	7.1	5.0	9.3
R'' (fixed ethers: Volatile ethers)	19.8	20.6	20.9	29.4
Total Ethers { Fixed ethers, per cent.	95.4 %	93.3 %	96.7 %	96.7 %
{ Volatile ethers, per cent.	4.6 %	3.7 %	3.3 %	3.3 %

TABLE III. — *Composition of the wine obtained with yeast 255.*

	Control	Sulphate	Phosphate	Asparagine
Alcohol	2°1	2°1	2°1	2°1
Total acidity	6.550 grm	6.930 grm	12.290 grm	7.360 grm
Fixed acids	5.262 "	5.510 "	11.030 "	5.940 "
Fixed ethers	2.460 "	2.380 "	2.312 "	2.755 "
R (fixed acids: fixed ethers)	6.3	6.7	6.7	2.4
Volatile Acids	1.030 grm	1.134 grm	1.203 grm	1.134 grm
Volatile ethers	0.169 "	0.244 "	0.325 "	0.315 "
R' (volatile acids: volatile ethers)	8.9	6.8	5.4	5.3
R'' (Fixed ethers: Volatile ethers)	12.4	8.4	6.5	7.4
Total Ethers { Fixed ethers, per cent.	91.8 %	80.3 %	85.9 %	88.3 %
{ Volatile ethers, per cent.	8.2 %	19.7 %	14.1 %	11.7 %

These tables show, not only the difference in action of the three yeasts but also the influence of the form in which the nitrogen was supplied. The results of yeast 7 (Saint Emilion) are near to those of yeast 32, while showing certain differences as regards the influence of the phosphate and asparagine; yeast 94 of Burgundy showed much resemblance to yeast 88 of Burgundy, but it differed by the low fixed ether content in the asparagine test; the ratio R'' fell to 13.1. When a strong 88 yeast and a pointed 255 yeast are sown in the same medium, the first gains the upper hand, nevertheless the presence of this pointed yeast is shown by the increase of volatile ethers and acids. In this case the ratio R'' (fixed ethers: volatile ether) found by experiment and also calculated by taking the average results found for each yeast separately are shown in Table IV.

TABLE IV. — *Value of the ratio R''*

	Control	Sulphate	Phosphate	Asparagine
Yeast 88	19.8	26.6	26.9	29.4
Yeast 255	12.4	8.4	6.1	7.4
Value of R'' calculated for wine obtained by using 88+255	16.1	17.5	16.5	18.4
Experimental value of R'' for wine obtained by using 88+255	16.2	16.8	10.1	18.2

The series *A* showed that the different yeasts could subsist with only small quantities of nitrogen, the ratio between the nitrogen and the invert sugar on the control being $\frac{1}{100}$. In a second series *B* the sugar content was increased by adding 100 grm of saccharose per litre of must, the ratio between the nitrogen and the invert sugar of the control becoming $\frac{1}{1102}$. In the series *B*, a comparison was made between two yeasts of white vintages and which were more accustomed to a high percentage of alcohol: Folle blanche yeast N° 101 of Cognac, that of Sauterne N° 42, as well as 32 yeast of Langlade, coming from black grapes.

The amount of nitrogen added in the three forms was the same in series *B* as in series *A* (1 % of nitrogen). In a third series *C*, the sugar content being the same as in *B*, the nitrogen content provided by all three compounds was increased to 1.7 % and the action of yeast 32 was studied.

Table V shows the general results of these experiments.

TABLE V. — *Modifications, due to the different nitrogenous compounds, in the wines obtained by the action of yeast 32.*

Media	Fixed acids			Volatile acids			Fixed ethers			Volatile ethers		
	A	B	C	A	B	C	A	B	C	A	B	C
	g	g	g	g	g	g	g	g	g	g	g	g
Control must.	100	100	100	100	100	100	100	100	100	100	100	100
Sulphate media.	116	98	94	172	60	79	123	106	103	79	103	175
Phosphate media.	117	102	122	326	120	100	345	174	149	129	113	350
Asparagine media.	110	98	102	437	120	109	285	129	202	69	106	91

This study shows that the different yeasts behave very differently as regards their food nitrogen, while the nature of that element has a marked influence on their power of producing ethers. The wine maker who uses

selected yeast, whether in the first fermentation or in the second, to obtain a certain commercial result, can thus aid etherification by adding nitrogen as sulphate or phosphate of ammonia; the etherifying and synthetic powers of the yeasts are susceptible of improvement.

86 - **The Relationships between the Development of the Flowers of Wine and the Watering of Wine** (1).—L'EROTTI R. and BERNARDINI P., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part 9-10, pp. 437-496, 6 fig. Modena, 1916.

Work carried out at the Royal Laboratory of Agricultural Bacteriology and at the Municipal Chemical Laboratory of Rome, with the object of ascertaining the scientific value of the popular opinion that the development of the flowers of wine (*Mycoderma vini*) is an indication of their watering, and if this is so, within what limits the progress of development can serve to determine the watering.

The method used, and which will be used for further researches is thus described:

With a filtered sample of wine, a series of 9 samples are prepared diluted progressively at the rate of 10 per cent. 50 cc. samples are taken from the original wine and from each of the 9 dilutions, each 50 cc. being poured into a sterile 500 cc. Erlenmeyer flask. The amount of liquid taken should never be higher (100 cc.) save in the case when the maximum weight of flowers to be obtained is less than 20-30 mgr. Each sample is inoculated with 1 cc. of a mixture of pure cultures of different varieties of *Mycoderma vini*, and the flasks, stoppered with cotton wool are kept in an incubator at 28° C. After 5 days of incubation each liquid is filtered through a tared filter, and the precipitate is washed. It is then dried in an oven at 110° C. for an hour, and weighed. The resulting weight is considered as consisting entirely of the dried *Mycoderma* developed in the liquid, and a curve is plotted using the weights as ordinates, and the degree of watering of the liquid as abscissae.

Using 20 specimens of wine whose purity was not questioned, the following results were obtained:

1) Sweet, natural wines are found to contain the flowers without having been watered.

2) The dried body weight of *Mycoderma* in sweet wine reaches the maximum in a pure sample, it decreases slowly as the dilution progresses. When the watering has reached 50 per cent, it decreases rapidly.

3) Natural dry wines act differently to sweet wines as regards the development of *Mycoderma vini*. In pure, unwatered dry wines, the flowers do not develop after 5 days under the most favourable conditions. In a progressive series of dilutions of the same pure, dry wine, the dry weight of the flowers produced is shown by the path of a curve whose culminating point approximately corresponds to a medium watering (40 to 60 per cent).

4) The presence of relatively small quantities of sugars in certain pure

(1) See also B., 1915, No. 152.

wines, does not cause, so far as these researches are concerned, a behaviour different to that of dry wines.

5) In the highest terms of the water dilutions of a pure, dry wine, there develops along with *Mycoderma vini* the *Bacterium aceti* which has no influence on the previous phenomena, in the sense that its action is equal for all the samples; also the results remain comparable.

6) The curves of the dry weight of the flowers, plotted for 2 series of water dilutions: a) of a pure dry wine, and b) of the same wine adulterated by adding 25 per cent of water, are different in so much as the curve of the watered wine shows a characteristic and noticeable deviation.

7) The average dry weight of the flowers produced in 17 samples of pure dry wine that were studied, show 3 characteristics in the resulting curve:

a) a slight increase corresponding to the 10 per cent dilution.

b) a rapid increase with the 20 per cent dilution.

c) a slow decrease between the dilutions ranging between 50 and 90 per cent.

7 - The Analysis of Hungarian Wines, and the Minimum and Maximum Content of their Principal Constituents. — VUK M., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 32, Part 5, pp. 227-229. Münster i. W., September 1, 1916.

The results of maxima and minima ascertained between 1909 to 1916 at the Hungarian Station of Chemistry at Budapest, which yearly receives a thousand different samples of wine for analysis. The analysis was made according to the methods usually employed in Germany. The results are as follows:

Constituents	Contents	
	maxima	minima
alcohol	18.44% by volume in Kecske-meter. Muscat, Ottoriel wines, in 1907.	4.83 % by volume in a white wine of Nagykanizsa, in 1912.
total acidity (calculated as tartaric acid)	1.53 grm. per 100 cc. of a white wine of Stridofarkashegy of 1912.	0.30 grm. per 100 cc. of a Kecske-meter - Muscateller Wine, of 1908.
total extract	33.73 grm. per 100 cc. of a Tolesvaer wine, of 1901.	1.42 grm per 100 cc. of a white Versecz wine, of 1911.
gar-tree extract	9.61 grm. per 100 cc. of Bodrogkeresztur wine, of 1906.	1.42 grm. per 100 cc. of a white Versecz wine, of 1911.
verberine	1.92 grm. per 100 cc. of a Tolesvaer wine, of 1906.	0.29 grm. per 100 cc. of a Alsoszeged wine, of 1912.
alk	0.91 grm. per 100 cc. of an Oporto wine from Fehertemplon, of 1908.	0.09 grm. per 100 cc. of a white Magyarader wine, of 1908.
phosphoric anhydride . .	0.153 grm. per 100 cc. of a Fehertemplon wine, of 1913.	0.005 grm. per 100 cc. of a second class Mesökővesder wine, of 1913.

- 88 - The Filtration of the Lees of Wine. — See No. 75 of this Bulletin.
- 89 - Large Scale Sulphuring of Wines and Musts by Sulphur Dioxide produced directly by Burning Sulphur. — See No. 75 of this Bulletin.
- 90 - Earth-nut Oil and Cakes. — See No. 39 of this Bulletin.
- 91 - The Value of Seaweed as Raw Material for Chemical Industry. — HENDRICK J. in *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 10, pp. 565-574. London 1916 (1).

The writer considers the utilisation of seaweeds on the coasts of Scotland with a view to the possible development of this industry by means of a better organisation provided with more capital.

He gives a large number of analyses which allow the estimation of the averages set forth in the following Table.

Average amounts of ash, potash and iodine in some seaweeds.

Seaweeds	Number of specimens analysed	Ash in undried seaweeds	Potash in the ash	Iodine in the ash
<i>Laminaria digitata</i> stems	15	6.00 %	29.89 %	1.548 %
" " fronds	12	5.31	23.34	1.697
<i>Laminaria stenophylla</i> stems	8	5.75	33.73	1.045
" " fronds	8	4.72	19.90	1.364
<i>Fucus nodosus</i>	10	6.19	12.86	0.418
<i>Fucus vesiculosus</i>	8	6.38	14.95	0.177
<i>Fucus serratus</i>	8	5.60	17.57	0.220

This table shows that the stems of *Laminaria digitata* and of *L. stenophylla* are rich in potash and iodine, and they are the most likely seaweeds to form the basis of a permanent chemical industry. The *Fucus* family are less rich in potash and are very poor in iodine, but are, however, sufficiently rich in potash to make it worth while, during the present scarcity of that substance, to prepare ash from them for use as potash manure.

Experiments were made to find to what extent the potash and iodine could be extracted from *Laminaria* spp. without burning the seaweed. It was found that these two substances can be completely extracted from *Laminaria* in solution if the seaweed is first heated under pressure to about 100° C. The iodine can be readily distilled from the solution so obtained, but as there is much organic matter present, it is more difficult to recover the potash salts.

Analyses of *Laminaria* which had been dried in the ordinary manner, but with great care, and without any excessive exposure to weather, indi-

(1) See B. December 1916, No. 1261.

cate that very serious loss of potash and iodine takes place during the drying of the seaweed. On this account, the writer advises this operation being carried out under cheap shelters and suggests that the seaweed could also be burnt under cover and the heat of the combustion used to assist in the preliminary drying. He further proposes that drying experiments should be made on a large scale and their cost estimated.

The losses which take place during burning also require to be determined by large scale experiments. The results of laboratory experiments show that *Laminariae* may be burned at a full red heat till the ash is quite fused, without any serious loss of either potash or iodine, provided the seaweed is not mixed with any impurities, such as silica or lime, but if the latter substances are heated slowly for a considerable time together with the seaweed, there will be considerable loss of both potash and iodine; it is important therefore that in gathering the seaweed all admixture with sand should be avoided.

The writer recommends that the example of Japan should be followed. This country has organised a seaweed industry and is able to export large quantities of iodine; it also produces abundance of potash salts. It would also be well to imitate the manner in which the United States are dealing with the question of the Pacific seaweeds, and to undertake researches with sufficient funds and an adequate Staff, in order to solve the many scientific and technical questions with a view to founding a really efficient seaweed industry in Scotland.

The Preparation and Uses of Wood Flour. — KRESSMANN F. W., in *Scientific American*, Vol. LXXXII, No. 2127, p. 229. New-York, October 7, 1916.

Wood flour is ground or milled wood that has been screened so as to remove coarse particles and also to give a certain uniformity of size. It is usually sold as 40, 60, or 80 mesh (bronze wire screens having 40, 60, or 80 meshes per linear inch. In one specification, 20 per cent of the flour must pass through an 80 mesh, 50 per cent through a 60 mesh, and 100 per cent through a 50 mesh screen.

A good wood flour must be white, light and fluffy, and absorptive. Industries using it require a white or very light cream-coloured flour, although absorptive qualities are only specially required for making dynamite. Colour and weight considerations thus limit the species of wood to be used to the white, light, non-resinous conifers and to the white, broad-leaved woods like aspen and poplar. Spruce, white pine, and poplar are the species most often used. The wood must be barked before grinding, and round wood, barked slabs and sawdust free from bark may be used.

The wood is ground either in stone mills, or in steel burr roller mills. In Europe, particularly Scandinavia, where a good deal of wood flour is made, stone mills seem to be used exclusively and most of the early plants in the United States use this type of mill. The stones are from 40 to 60 ins. in diameter, and only the lower stone is driven, the upper one remaining stationary. Hydraulic turbines are used; as flour produced by other sources of power cannot compete with Norwegian flour ground by water power. The wood after barking is reduced to chip by the usual type of

chipper. These chips along with a certain proportion of the screenings are fed to the mills which are completely enclosed (with the exception of an opening at the top) with an iron or steel cover. Sufficient steam or water is added to prevent firing and to keep down the dust. The fine stuff from the mill is then drawn or blown through iron pipes or sheet metal ducts to the screening apparatus, which may be of several types and which may be either bronze wire or silk bolting cloth. After screening, the flour is packed in compressed bales or sacked and weighed automatically. Mills of this type require from 45 to 50 HP per 24 hrs per ton of flour produced, that is, about the same power requirement as for mechanical wood pulp.

Another type of mill was developed on the Pacific Coast about 25 years ago, being designed to handle sawdust as raw material. This grinder consists of a number of pairs of corrugated chilled steel rolls which turn towards each other. One roll turns three times as fast as the other, thereby actually cutting the sawdust as it passes through. The slower mill has its corrugations so arranged as to form pockets to hold the dust while the faster roll cuts.

There are three stands of rolls, the corrugations becoming progressively finer on each stand.

The sawdust is screened before reaching the first rolls so as to remove slivers, small blocks, etc. Then it is passed over a strong electro-magnet to pick out any iron present, and is also screened through bolting cloth to remove material of suitable fineness. The production of wood flour from sawdust in this type of mill requires only from 20 to 25 per cent. of the power required with stone mills.

Before the war, wood flour was delivered at the Atlantic ports of the United States for from \$ 12.50 to \$ 15.00 per ton, and domestic material had to compete against this. The production in the United States is mostly controlled by one firm, though mills are scattered all over the country from Maine to California.

Wood flour is principally used in the manufacture of dynamite, linoleum, artificial plastics and flooring, and as an inert absorbent in many industries.

In 1909, the amount of wood flour used for making dynamite amounted to about 20 million pounds, and is increasing every year.

Linoleum is made of either cork flour or wood flour mixed with a cementing material which is spread out on cloth or rolled in or compressed thereon hydraulically. Only wood flour is used for making inlaid linoleum because it allows of dyeing to any colour and then is permanent. The cement is made of oxidised linseed oil melted with rosin and Kauri gum. The cement is the most expensive constituent, as it costs from \$ 125.00 to \$ 175.00 per ton, depending on the price of linseed oil. Naturally the lightest flour produces the greatest volume of goods, for the raw materials of linoleum are bought by weight and sold by volume. Thus the weight per cubic foot, together with the colour, is of prime consideration to the manufacturer. Wood flour is, for this purpose, about 50 % better than cork flour.

Before the war, cork waste cost \$ 35.00 per ton, costing about \$ 5.00

to grind it with power costing 1.5 cents per kilowatt. Practically all cork flour used in the United States is manufactured in the country either from domestic waste or waste from Spanish cork mills. Cork flour is, therefore, worth about three times as much as wood flour; but since they both require equal amounts by weight of cement, and since the volume of goods produced from cork is so much greater than that from wood, the cork linoleum is cheaper for goods of equal thickness than wood flour linoleum. The latter also costs more to manufacture, requiring great expense for dies and also more labour; further it is less elastic than cork linoleum, though the wearing qualities of both are about the same.

For composition flooring, plastics, oatmeal paper, etc., the principal requirement is light colour, although in some cases certain woods are necessary as in the production of artificial bates for tanneries. The latter consists of a mixture of wood flour, ammonium chloride, and certain animal products that are absorbed by the flour. Here again the trade demands a light-coloured product, and it has been found that flour from broad leaved woods, like poplar, will cause a discolouration on storage, so that only flour from spruce or white pine may be used.

3. **The Pasteurisation of Milk for Cheese-Making.** — STEVENSON C. and GRANT W. (Dairy Instructors, Taranaki, New Zealand), in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. XII, No. 6, pp. 440-445, 3 fig. Washington, June 20, 1916.

According to the writers, (dairy-instructors at Taranaki, New Zealand) it was hitherto thought impossible to pasteurise the milk used for cheese-making on account of the large quantities of milk to be dealt with in the limited time available for the purpose, and the high cost of the necessary heating. The increase in fuel-consumption was from 15 to 20 per cent. A saving, however, can be effected by using a regenerative heater. Where water is scarce, the waste water can be cooled and used again. The best pasteurising temperature is from 71° and 75°·5 C. If the temperature is raised to 79° C., or above, the addition of 1 oz to 1 ½ oz. of hydrochloric acid per 100 gall. of milk, before adding the rennet, will be found to be an advantage.

Benefits derived from the pasteurisation. — The loss of milk which occurs exceptionally warm weather of long duration is avoided.

There is a considerable increase in the amount of butter-fat incorporated in cheese made from pasteurised milk. Instances of this were observed at Taranaki, for since pasteurisation has been adopted, not a single second grade cheese has been manufactured (a large percentage being obtained first), and the factory's average grade has risen from 89 points to 92. Thus the factory saves ¼ d per lb., which was the deduction for second grade cheeses. These satisfactory results have induced cheese manufacturers to increase the number of plants for pasteurising milk; from 7 in 1914-1915 they have increased to 32 in 1916.

A complete plant of 1 800 gallon capacity can be installed for £ 300.

It should not, however, be supposed that the good effects of pasteurisation lessen the responsibility of the farmer as regards the quality of the

milk, which will always remain the chief factor in determining the quality of the cheese made.

For instance, an experiment at Taranaki has shown that turnips fed to cows impart to the milk an unpleasant flavour which cannot be entirely eliminated by pasteurisation at 87.7° C.

94 - **On the Mechanical Protection and Conservation of Eggs.** — ARNOUX ANDRÉ, in *Comptes Rendus de l'Académie des Sciences*, 1916, 2nd. Half year, Vol. 163, No. 23, pp. 721-722. Paris, 1916.

The writer has sought a practical and cheap method for helping transport and conservation and requiring no special apparatus. To do this, the egg is wrapped in a soft envelope formed by bands of tissue which are dipped in a mineral paste that hardens and protects the egg.

Amongst the substances suitable for this, silicate of soda, already used for this purpose, gave the best results. The egg thus preserved is protected from shock and travels as if in a box. In practice the egg is still quite fresh at the end of about a month.

For consumption the egg is dipped into tepid water, when the mineral paste easily dissolves. Envelopes other than bands of tissue may be employed (wadding, saw-dust etc); and other food products are capable of being similarly protected.

95 - **The Strength of Eggshells.** — HERRASTI G., in *Scientific American*, Vol. XCV, No. 13, p. 321, 1 fig. New-York, October 7, 1916.

The strength of eggshells has been ascertained by placing them on the plate of a pair of scales and submitting them to gradual pressure by means of a lever and jack. It was found that coloured egg shells are stronger than white ones. The average breaking pressure for brown shells reached 70.3 kg., while white shells only required 51.07 kg. to break them.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

6 -- **The Noxious Action of Sea-salt deposited on Sea-shore Plants.** — DUFRENOY JEAN, in *Comptes Rendus des séances de la Société de Biologie*, Vol. LXXIX, N° 17, pp. 914-916 Paris, 1916.

In 1915 and 1916, researches were carried out in the Laboratory of the Biological Station at Arcachon in order to watch the progress of the mortification caused by the deposition of microscopic drops of sea water, specially on the green organs of the cluster pine (*Pinus pinaster*), Sea Holly (*Eryngium maritimum*) and Broom (*Sarothamnus scoparius*), plants growing on the sand dunes.

In such a case, the pine needles are first seen to be covered with clear, translucent, yellow spots which turn brown as they dry. Finally, on account of the difference of water content between the spots and the neighbouring healthy parts, they become twisted out of their vertical axis; and the roots, in extending, cause the ends of the needles to become deformed. On the leaves of *Eryngium* the spots are at first brown, become transparent, but remain bordered with brown. On broom, the young branches become brown, and in consequence of the disappearance of the parenchymatous bark, they are reduced to the central woody cylinder. The spots, at any rate at first, are always covered with white dust, of a salt taste, and which is composed of crystals that are seen to be chlorides from microscopical and chemical examination. The dust evidently comes from spray carried by the wind, as it is only found on exposed parts and not on those that are sheltered.

The mortification of the attacked regions commences round the stomata, the salt water having penetrated into the air-chambers. The cells are first plasmolysed: the chlorophyll grains disintegrate; the cell membranes are deformed, and being torn, allow the protoplasm to escape and collect at the stomal opening and even exude on the external surface. Blisters appear in the leaf parenchyma which collapses or wrinkles and be-

comes finally reduced to its two epidermal surfaces (1). In most case the protecting epidermal tissues remain intact and only become involved when the contractions of the subjacent parenchyma breaks them.

The vegetative organs exposed to the sea winds are, in consequence, prevented from developing and often decayed during their period of growth. The organs on the unexposed side alone can develop in the shelter of the dried-up remains of the organs facing to wards the sea. The plants consequently assume a characteristic dissymetric shape.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

- 97 - On the Hibernation and Spread of Cereal "Rusts" in Sub-tropical Climates -
GASSNER GUSTAV, in *Zeitschrift für Pflanzenkrankheiten*, Year 1916, Vol. 26, Parts 6-7,
pp. 329-374. Stuttgart, Sept. 16, 1916.

The observations upon which the present paper is based were made during the period 1907-1910, in the eastern portion of South America (Uruguay, Argentine, Southern Brazil) where the climate is subtropical and "rusts" appear regularly every year. However, not all the European species of these fungi occur, South America only possessing *Puccinia graminis*, *P. trititica*, *P. coronifera* and *P. Maydis*. Nevertheless, in view of the international nature of the "rust" problem the observations made in this region still possess a general interest.

The principal results of this very thorough research were as follows:

- 1) The cereal "rusts" of tropical South America (*P. trititica*, *P. coronifera*, *P. graminis*, *P. Maydis*) appear in uniform manner but are differentiated among each other by the method of wintering.
- 2) In the case of *P. trititica* and *P. coronifera* it is the uredospores which hibernate, and new formation of spores and fresh infections are observed throughout the winter.
- 3) In the case of *P. Maydis*, wintering of the uredospores is unknown as there is no winter maize in subtropical climates.
- 4) Nor in the case of *P. graminis* has any wintering of uredospores been observed. The host plants of this "rust" are nevertheless very numerous during the subtropical winter, but their environment or state of development are such that they are not infected by the uredospores.
- 5) Nevertheless, there is a very slight possibility that germinating uredospores of *P. graminis* may develop during the winter on well sheltered growing plants, or may hibernate among vegetable refuse.
- 6) Neither for *P. graminis* or other species of "rusts" have any conclusive facts been ascertained as to wintering by means of mycelia in plant tissues.

(1) A transverse section through the edges of the spots shows all the stages between healthy and completely deformed cells.

7) Notwithstanding the regular formation of teleutospores, no case of wintering by means of teleutospores and change of host has been observed either for *P. graminis* and *P. Maydis*, nor for *P. triticea* and *P. coronifera*.

8) Nor has any case been observed of wintering and transmission of "rust" by means of the grain. Especially striking is the absence of facts in favour of ERIKSSON'S "mycoplasma" hypothesis. But no endeavour was made to ascertain possible cases of transmission by means of spores mycelium attached to the grain, that is to say, with the exception of a series of isolated experiments which it is necessary to repeat.

9) From what has been said in paragraphs 3-8 it follows that *P. graminis* and *P. maydis* have not been proved to hibernate in the sub-tropical climate of Uruguay. It must therefore be considered that these "rusts" pass the winter in another country and that they are transmitted every year by means of air currents.

10) This supposition finds a certain amount of support in the fact that *P. graminis* hibernates in the form of uredospores in Southern Brazil only, whilst in tropical Brazil uredospores of *P. Maydis* have been found at periods when no maize fields are in existence in the Southern sub-tropical part of the country.

11) Proofs have also been forthcoming in support of the transmission of "rusts" by air currents. In order to appreciate this method of transmission, account must be taken of the extent of the area under cereals. In countries producing a large amount of grain the big areas lend themselves admirably to the reception of spores; these latter may still contribute towards the transmission of the "rust" even in those cases where, owing to the smallness of their numbers, it is not possible to determine the presence of spores in the atmosphere or means by the methods of capture in use ("Pilz-fallen").

8 - Biological Observations on *Roestelia cancellata*, a Rust attacking the Pear. — TROTTER A., in *Rivista di Patologia vegetale*, VIIIth year, N° 3, pp. 65-76 Pavia, 1916.

Roestelia cancellata (Jacq.) Reb., the acedial form of *Gymnosporangium Sabinae* (Dicks.) Wint., develops yearly in more or less abundance in the different varieties of pear trees cultivated in the neighbourhood of Avellino (Italy). As is already known, *R. cancellata* exists in connection with *Juniperus Sabina* L. on the branches of which plant there is produced annually the form with teleutospores (*Gym. Sabinae*) the agent producing the infection on the pear tree. The author's investigations have determined the presence, in the neighbourhood of Avellino, of specimens of *G. Sabina* which are annually infected with *Gymnosporangium*.

This form bearing teleutospores appears as early as January and reaches its full development at the end of March or the beginning of April. Owing to the quantity of fine rain which almost invariably falls at this period, the sori bearing the teleutospores undergo a process of gelatinisation. During the course of this latter following the germination of the teleutospores, sporidioles (basidiospores) are formed at the surface of the sori.

It is immediately after the period of gelatinisation that the fungus begins to become infectious for the pear tree, but for this tree only, which at this particular moment is in a state of receptivity to infection by the sporidioles. According to the writer, the teleutospores are of no importance from the point of view of dissemination. Plants of *Crataegus Oxyacantha*, *Pyrus Malus*, *Cydonia vulgaris*, living in the same locality infected with *Gymnosporangium*, are never attacked and they are further quite immune to artificial infection. On the other hand, such infections are always successful on the pear tree and that without there being any necessity to wound the leaves. It is sufficient to damp the surface slightly with a soft brush which has been moistened and passed over the gelatinised sori of *Gymnosporangium* in order to pick up the sporidioles.

In the case of *Gymn. Sabinae* it seems that the diffusion of the sporidioles can only be carried out by the agency of the wind, for the progressive diminution of the infection of pear trees becomes much more evident the further one proceeds from the centre of infection formed by the individuals of *Juniperus* attacked by *Gymnosporangium*.

The writer considers it not improbable that the sporidioles in suspension in the atmosphere may be forced vertically downwards by the rain and so deposited on the leaves of the pear tree.

The results of experiments in artificial inoculation and the behaviour of the fungus in nature have led the writer to the belief that the best period for treatment with fungicides having copper salts as their basis (in relation to the fungus) is that extending from the time of gelatinisation of the sori bearing the teleutospores till the complete dispersal of the sporidioles. In relation to the plant the best period is that comprised between the appearance of the first shoots and the development of the first wood-buds; in relation to the weather (approximately) the period covering the first few days of April and the end of May. During this period, two, or at the very most, 3 treatments at intervals of a fortnight should be sufficient to deal with *Roestelia*.

Experiments were also made to determine whether it is possible for the mycelium of *Roestelia* to penetrate the branches of the pear tree and establish itself in this way. In this connection several pear trees were chosen which every year without fail were badly attacked by *Roestelia*. After establishing that release of the sporidioles should not occur before April 15, 1915, the writer protected one of these trees by means of a cloth tent, in such a way as to give effective protection against infection from outside. In the case of another plant growing in the neighbourhood of the first, several buds were enveloped in small bags of parchment. On the 4th July, both parchment bags and cloth tent were removed and it was found that the measures taken were so effective that neither tree showed the slightest trace of *Roestelia*.

As a consequence of this experiment it seems definitely settled that in normal conditions at least there is no hibernation, and still more definitely that there is no question of *Roestelia* establishing itself by means of a mycelium. It follows, therefore, that the infection must be renewed

annually by means of the sporidiales of *Gymnosporangium* derived from *J. Sabina* and other related species which may also eventually act as hosts for this fungus (*G. Oxycedrus*, *G. phoenicea*, *J. virginiana*, *G. Japónica*, *G. macrocarpa*, *G. tripartita*, *G. excelsa*).

If, in view of what has been said, *J. Sabina*, or allied species are found to any great extent as constituent elements of woods or thickets and it is not considered advisable to destroy them, recourse must be had to the control of *Roeselia* by means of fungicides at the most opportune period as discussed above. Where *J. Sabina* and closely related species only occur sporadically, being cultivated for ornamental purposes, the writer advises the adoption of legal measures to enforce destruction.

19 - *Castanea mollissima*, a Chinese Chestnut tree Resistant to *Endothia parasitica*. — See No. 18 of this Bulletin.

20 "Uspulun" a New Preparation for the Treatment of Cereal Grains against Fungoid Diseases (1). — WEEB in *Illustrierte landwirtschaftliche Zeitung*, 36th year, No. 82, p. 552. Berlin, 1916.

A new preparation for the treatment seed of grain known as "Uspulun", has been placed upon the market and is said to be capable of destroying all fungal spores occurring on the surface of the grain. The diseases in view are chiefly "stinking smut of wheat", the *Fusarium* attacking wheat and rye, *Helminthosporium gramineum* of barley and, according to ERIKSSON, "loose smut of oats" (*Ustilago avenae*). The remedy might also be adopted for seeds attacked by bean anthracnose (*Gloeosporium Lindemuthianum*) and pea anthracnose (*Ascochyta Pisi*).

The active principle contained in the remedy is chlorophenate of mercury, in the proportion of about 20 %. The remaining 80 % is made up of various agents intended to render the preparation more soluble and to protect it from moisture.

The mercury content is about 12 %. To ensure recognition of seeds treated with "Uspulun" a blue colouring matter has been added.

Experiments covering a period of 3 years have been carried out at the Agronomical Institute of Giessen University in order to determine the effect of "Uspulun" treatment on the germination of the seeds and on the action of the fungi during germination.

It was also wished to determine whether "Uspulun" really constitutes an effective remedy for the control of "stinking smut". If so, the next question to be studied is that of expense. For comparative purposes, the seeds were also treated with copper sulphate, formalin and sublimate.

I. — *Effect on Germination and Action of the Fungi*. — The seeds were immersed in the "Uspulun" solution and allowed to remain there for some time. No spraying was carried out, the effect of the solution on the germination capacity being less marked by this method than by the immersion process.

(1) See also B. Oct. 1916, No. 1146.

(Ed.).

The germination energy ("Keimenergie") and germination capacity ("Keimkraft") of rye and barley were increased several degrees by the treatment with "Uspulun".

The germination energy shows a stronger increase than the germination capacity. The reason is to be found in the destruction of the fungi, especially of *Fusarium*, which impeded the course of germination in the non-treated samples.

The favourable effects of the treatment were shown still more distinctly in the case of the determination of the growth capacity ("Triebfähigkeit"). The optimum value of concentration of the solution was almost in every case from 1:200 and 1:900 (the instructions given by the manufacturers say: 1:300). Rye forms an exception as its germination energy only shows an increase with the weakest of all the solutions i.e. 1:800. Treatment with "Uspulun" produces no increase in the germination capacity or in the growth capacity of barley and oats.

Sublimate (15 minutes immersion in a 0.1 % solution) diminished the germination energy of wheat. On the other hand the germination capacity remained unchanged. There was a distinct increase in the growth capacity in comparison with the non-treated samples, as was also the case with Uspulun; this increase, however, was 20 % less than with "Uspulun". The germination capacity and the growth capacity were the same as those of the samples treated with "Uspulun". The growth energy and the growth capacity showed an increase of nearly 10 % on those of the non-treated samples.

The treatment with sublimate had no adverse action whatever on the germination capacity and growth capacity of barley and oats; however, it lowered the germination energy of the barley.

The wheat grains seemed to have suffered no damage from an immersion of a quarter of an hour in a 0.1 % solution of formalin. The germination capacity and the germination energy remained the same as for the non-treated seeds. On the other hand there was a big difference in the growth capacity.

The effect of formalin on rye was similar. The germination value ("Keimwert") was slightly diminished for oats and remained unchanged for barley.

Copper sulphate (0.5 % solution; 15 hours immersion) usually had a very deleterious effect on the germination of rye and wheat.

It is true that a subsequent treatment with milk of lime caused an appreciable improvement in all the factors, however, they were superior to these of the untreated samples in one single case only (growth capacity of wheat). The results of treatment with copper sulphate were no better for barley and oats, although in this case also, the factors may all have been considerably improved by a subsequent treatment of the seeds with milk of lime.

Treatment with "Uspulun" surpasses all the other methods examined. Next comes corrosive sublimate, and then formalin and finally copper sulphate, with and without treatment with milk of lime.

II. — "*Uspulun*" as a remedy for "stinking smut". As early as 1915, field trials were made on the control of "stinking smut" and "loose smut of oats" but without result owing to the failure to produce artificial infection by means of spores. A new attempt was made in 1915 with autumn wheat severely attacked by "stinking smut" and this time the experiment was successful. The results are as follows:

Treatment of seed		Growth	Proportion of wheat attacked by stinking smut
Untreated	washed	good.	37.8
	dry	"	50.8
"Uspulun"	immersed	very good	0.0
	sprayed	"	1.5
Sublimate	immersed	slightly irregular	0.9
Copper sulphate	"	irregular with gaps	0.0
Copper sulphate followed by treatment with milk of lime		good.	0.27
Formalin		good.	0.1

The expenses of treatment with "Uspulun", when the spraying method is adopted, are from 3 $\frac{1}{4}$ d. to 4 d. per acre for wheat; from 2 $\frac{1}{4}$ d. to 3 d. per acre for rye. The immersion method comes dearer for small quantities of seed, but comes as low as 4 d. per acre for large quantities.

— *Puccinia glumarum* on Wheat in Salt Lake Valley, Utah, U. S. A. — O'CARA P. J., in *Science*, New Series, Vol. XLIV, No. 1139, pp. 610-611, Lancaster, Pa., 1916.

Towards the end of June 1915, the author and Mr W. W. JONES discovered an apparently new rust on wheat in fields to the North W. of Ogden (Utah). The infection seemed to be considerable.

Examination of the specimens showed that the rust was *Puccinia glumarum* Erikss. and Henn, already reported at Sacaton (Arizona).

Work will be carried out on the presence and distribution of this "rust" and the damage it causes to wheat in Salt Lake valley and the surrounding tract.

— *Bacillus Omellanskii* n. sp. as the Cause of "Bacillary Gummosis" of Sorghum. — СЕРБИНОВ Н. Л. (SERBINOV I. L.), in *Болезни растений, журнал Центральной Фитопатологической станции Императорского Ботанического Сада Петра Великого*. (Plant Diseases, Bulletin of the Central Station of Phytopathology of the Peter the Great Imperial Botanical Garden), Nos. 4-5, pp. 95-113, Petrograd, 1915.

In July 1915, the Central Phytopathological Station of the Peter the Great Imperial Botanical Garden received from M. N. G. ZAPROMETOV entire plants of sorghum attacked by a disease which was subsequently identified as being perfectly new and was named by the present writer "bacillary gummosis". These plants were derived from three fields belonging to the Experiment Station of Golodnaja Steppa (region Samarkand), throughout which the disease occurred on a large scale.

According to the writer, the disease showed the same symptoms on all three plants in question: the neck was the part attacked, the roots remaining perfectly healthy. According to M. ZAPROMETOV, the disease also attacks the roots. The neck of the plant turns black, gives off a characteristic smell of butyric acid and is affected with damp rot. The tissues of the diseased portion become so macerated that at certain points they may easily be separated cell by cell by means of a needle. The diseased portions secrete a brownish black dense mucous substance of syrup-like consistency which fills the intercellular spaces.

No bacteria have been observed in the cells of the diseased portions, but the intercellular spaces, on the other hand, were full of the new butyric bacteria called by the author *Bacillus Omelianskii*. In a few cases minute-butyric non-sporing bacteria of the *Clostridium* type were observed but the chief mass of the bacteria belonged to *B. Omelianskii*.

The essential feature of the disease consists in the maceration of the tissues and cells of the infected portion (pectic fermentation) and then in the butyric fermentation. Following a summary of the types of bacteriosis of Gramineae as described by other observers, the writer gives it as his opinion that the one now under discussion is new to science. The morphological and pathological changes which it produces consist chiefly in maceration of the tissues and cells, a feature which though constantly present in numerous other types of bacteriosis, has hitherto never been recorded for bacterial diseases of cereals.

The morphological characters of *B. Omelianskii* are as follows: length $0.85 - 2.12 \mu$ and width $0.85 - 1.27 \mu$; elongated, short and almost square forms have also been observed. Occasionally twin forms are noticed. The bacterium is immobile and devoid of any motile organ. A typical feature is that it has the appearance of being truncated at the extremities. The usual size of the spores is maximum length 0.85μ , max. width 0.42μ . Attempts to secure a pure culture in artificial media were unsuccessful. In company with *Micrococcus candidans* the bacillus gives rise to a powerful butyric fermentation which, alone, it is incapable of producing. It stains well with methylene blue and behaves in quite a characteristic manner in relation to the GUMSA-ROMANOVSKYJ colouring method. Whereas, by this method, the majority of bacteria stain a blue colour, *B. Omelianskii* behaves differently: usually the bacteria stain a practically uniform pink and only at the moment of sporing does a portion of the protoplasm stain a blue colour. By means of this phenomenon the author has been able better to observe the process of sporing in *B. Omelianskii*: only a definite portion of the protoplasm is concerned by becoming concentrated about a given point. At the end of the sporing period the spore acquires a wall of its own, the remainder of the cell separating off and leaving at the surface of the spore a portion of the protoplasm which readily takes up aniline dyes.

Among methods of control of this new disease of sorghum, the writer recommends careful working of the surface layer of the soil, de-

working of the soil, in severe cases soil disinfection with formalin and finally, also, the choice of a suitable rotation.

Attention is drawn to the fact that "bacillary gummosis" of sorghum has been observed under conditions where there can be no question of excess of moisture, the cause of so many varieties of bacteriosis. As an explanation of this apparent contradiction, the writer observes that diametrically opposite physical and chemical agents have often the same action on bacteria and that it is probable that not only excess moisture but also drought and many other factors unfavourable to cultivation exert a similar influence on infection of the plant by bacteriosis. Finally attention is drawn to the necessity for the adoption of scientific methods in the cultivation of sorghum.

A table and bibliography with 47 references accompanies the text.

23 - **Diseases of the Sugar-beet observed in Austria-Hungary.** — See No. 12 of this *Bulletin*.

24 - **Diseases and Pests of the Coffee Plant in Reunion.** — See No. 36 of this *Bulletin*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

25 - **The Control of Locusts in Various Countries.** — *International Institute of Agriculture. Bureau of Agricultural Information and Plant Diseases.* 1 vol. in 16mo., pp. XVI-187. Rome, 1916.

The control of locusts is a problem of considerable interest for a large number of countries.

In view of the practical utility of a publication which would contain as exact and complete an account as possible of all the various methods adopted throughout the world to deal with these pests, the Institute has opened an international enquiry. As a result of this enquiry a mass of information has been collected and published under one cover, thus making available a complete and up-to-date review of this important question.

As confirmation of the timely nature of the enquiry we have now received the proposal of the Director of Agriculture of the French Protectorate of Morocco, to the effect that the Institute should take the initiative in summoning an International Conference (to be held at Rome) to deal with the control of locusts.

The Permanent Committee, on the proposal of M. LOUIS DOP, Delegate for France and Colonies and Vice President of the Institute, has approved the following resolution:

"The Permanent Committee, approving the proposal of M. LOUIS DOP on behalf of the Government of Morocco to summon an International Conference at Rome, in accordance with Art. 9, letter f, of the Convention of June 7, 1915, to deal with the control of locusts, has decided:

1) to adopt the principle of the proposal made by M. LOUIS DOP on behalf of the Government of Morocco;

2) To give effect to this proposal by inviting all the States adhering to the Institute to participate in the work of the Conference and if they think fit to send their representatives;

3) to hold this Conference before the next meeting of the General Assembly.

4) The date of the Conference is to be fixed as soon as the necessary preliminaries have been completed with regard to the various Governments interested."

For the above Conference the present publication of the Institute may serve as a preparation. This work contains data, properly coordinated, relating to 110 countries. The data relating to the few countries which have not yet been able to reply to the Institute's enquiry will be published subsequently.

The work is divided into six chapters the first of which deals with the subject from the historical point of view and treats of the distribution of locusts in the 5 continents of the world in turn.

The second chapter contains a list of the Orthoptera — more than 140 species — generally classed under the name of locusts and recorded as more or less destructive to agriculture in the various countries previously enumerated. The scientific name of each species is accompanied by the name of the locality in which the particular insect has been observed; the names of the localities most severely affected are marked by an asterisk. Wherever possible the local common name has also been given. The nomenclature and classification is founded on the well-known work of W. E. KIRBY; however, in order to avoid all chance of error, the synonyms must in use have been added in cases where such a precaution seems necessary.

Owing to their importance from the point of view of control, a long account has been given in the third chapter of all the data collected on the biology and habits of locusts. The place here has been to give the different data referring to each single species for all the various countries where it occurs. Next comes a summary of all the data connected with the life cycles of the different species. Finally, attention has been paid to the habits of locusts in general, time etc. of their appearance and migrations in the various countries, the causes determining the formation of swarms, migrations, reproduction and finally, their food.

The present organisation in the various countries for dealing with the pest is discussed in the chapter following as, for instance, legislative and administrative measures, among which those adopted in the British and Portuguese possessions in Africa and emanating from the "South African Central Locust Bureau" (situated temporarily at Pretoria) are particularly worthy of attention. The agreement concluded in 1913 between the countries of South America with reference to the centres of origin of *Schistocerca gregaria* is also discussed, in addition to the financial measures adopted in the various countries and other measures having their origin in private effort.

In the fifth chapter particular attention has been paid to the various methods of control, whether natural, mechanical, physical or chemical.

Chapter VI deals with the value of an international agreement as a rapid and efficient method of resolving the problem of locust control.

The work concludes with a Bibliography containing over 500 references, now properly classified for the first time. It also comprises many extracts from all kinds of publications including the most recent, which have been drawn upon to a large extent in the compilation of the work under notice.

106 - *Coccidae* observed in the Seychelles Islands. — GREEN E. E., in *Bulletin of Entomological Research*, Vol. VII, Part 2, pp. 193-196, Fig. 1-3, London, 1916.

The writer describes, chiefly from the systematic point of view, the following species which are new to science and which were sent by Mr. R. Dupont:

1) *Aspidiotus (Chrysomphalus) ansei* found on the leaves of the coco

at palm at Anse aux Pins; 2) *Gymnaspis grandis* on fruit of "Coco de or" (*Lodoicea sechellarum*) at Praslin; 3) *Lepidosaphes duponti* on leaf stalks of coconut palm at Silhouette.

Since the publication (in Trans. Linn. Soc. Lond. XII, part 2, p. 197, 1907) of a list of *Coccidae* occurring in the Seychelles, the following species have been identified in collections received from Mr. Dupont:

1) *Lecanium mangiferae*, Green; on Cinnamon and imported Mango plants; *Aspidiotus dictyospermi pinnulifera*, Mask; on *Jasminum*, *Thunbergia Pandanus* and Coconut; 3) *Aspidiotus bromeliae*, Newst.; on Pineapple plants; 4) *A. ansei* Green on *Cocos nucifera*; 5) *Ischnaspis filiformis*, Bougl.; on Oil Palm; 6) *Gymnaspis grandis* Green on *Lodoicea*; 7) *Parlatoria ergandei* Comst. on *Thunbergia*; 8) *Lepidosaphes dupont* Green on *Cocos nucifera*.

The list of species recorded from these islands is still a very small one, and the number of genera represented is extraordinarily poor. It includes *Cercia* (1 sp.), *Asterolecanium* (2), *Pseudococcus* (2), *Pulvinaria* (2), *Ceroplastes* (1), *Vinsonia* (1), *Lecanium* (7), *Chionaspis* (1), *Hemichionaspis* (2), *Diaspis* (1), *Aspidiotus* (8), *Lepidosaphes* (4), *Ischnaspis* (1), *Gymnaspis* (1) and *Parlatoria* (1); a total of 15 genera and 35 species only. Such widely distributed genera as *Orthozia*, *Antonina*, *Eriococcus* and *Fiorinia*, are as yet unrepresented in the Seychelles.

67 - The Fruit Flies Occurring in India, Burma, and Ceylon (1). — BEZZI M., in *Bulletin of Entomological Research*, Vol. VII, Part 2, pp. 99-121. London, 1916.

After having given a table of the Oriental and Australian genera of *Cinae* at present known, the writer gives a detailed description of the following species.

1) *Dacus* (*Leptoxyda*) *longistylus* Wied from Balighai, near Puri, Orissa, and some others from Coimbatore and from Nagpur, on *Calotropis*.

2) *Dacus brevistylus* Bezzi from Hagari, Siddhout, Cuddapple, and Madras in melons.

3) *Chaetodacus ferrugineus* F. from Peradeniya Ceylon; from Katuar, Purneah District North Bengal; and from Pusa, Bihar, bred from the fruits of guava and loquat; from Mandalay, on mango; from Myit Kyina, Upper Burma, in peaches and pomelos (*Citrus decumana*); from Maymyo, Upper Burma, in larval condition in mango. 4) *Chaet. ferrugineus* *rsalis* Hendel from Peradeniya; Pusa in loquat; Coimbatore on mango; Madras, Peshawar district bred from *Prunus persica*; Mandalay in mango and in *Capsicum frutescens*; Myit-Kyina on *Citrus decumana* and *Psidium wayata*; Lashio and Tatkon, Upper Burma in *Solanum verbascifolium*; Maymyo on *Capsicum* sp. *Pyrus communis*, and *Prunus Persica*; 5) *Chaet. ferrugineus incisus* Walker, from Kuman; Pollibetta, South Coorg, bred from "jak fruit" (*Artocarpus integrifolia*); from Santikoppa North Coorg from fruits of *Careya arborea*; Bangalore on mango leaves and on the fruits of *Psidium guajava*; Coimbatore, attacking mango fruits; Tat-

(1) See also *B.* January 1913, No. 128 and *B.* November 1915, No. 1226.

(Ed.)

kon, Upper Burma, in *Solanum verbascifolium*; Lashio on the same plant and Taung-gyi; 6) *Chaet. ferrugineus versicolor* var. nov. from Peradeniya, Pusa on fruits of *Ps. Guayava* and *Achras Sapota*; Coimbatore in many fruits; 7) *Chaet. zonatus* W. W. Saunders, from Pusa on *Prunus persica* on *Ficus* sp. cultivated, on *Achras Sapota* and from ripe fruit of *Aegle marmelos* ("Bael"); Santikoppa, from fruits of *Carega arborea*; Amnol Moradabad on mango fruits; Pachmarhi in peach fruits and Nagpur in *Lagenaria vulgaris*; Taru, bred from *Prunus persica*; 8) *Chaet. tuberculatus*, sp. nov. from Taung-gyi and Myitkyima, in *P. persica*; 9) *Chaet. constrictus* nom. nov., Pusa from *P. persica*; Coimbatore on mango; Guindy Madras; Hagari Bellary Dist. Madras, on a leaf of *Ricinus*; 10) *Chaet. duplicatus* n. sp. from Pachmarhi, on *P. persica*; 11) *Chaet. diversus* Cog bred originally from oranges, observed at Pusa on "jama leaves" (*Eugenia jambolana*), and on *Sinapis*; Bangalore on mango leaves; Machavaram Goudavari Dist; Coimbatore; Nagpur on *Lagenaria vulgaris*; Dehra Dun, on grass; 12) *Chaet. maculipennis* Dol.; Coimbatore on "chola" (*Andropogon sorghum*); Minbu, Lower Burma on *Vitis* sp.; 13) *Chaet. hageni* from Meiktila, Upper Burma, on *Cucurbita* sp.; 14) *Chaet. cucurbitae* Cog, Dehra Dun on grass; Dhoni, Krishna Valley; Poona and Calcutta; Pusa on "pepper" (*Tricosanthes dioica*) in the fruits of *Cucumis*, *Momordica Charantia*, *Cucurbita* spp., in fruits of *Luffa aegyptiaca*; Lyallpur, Punjab, on *M. Charantia*; Coimbatore on *Cucurbita Melo*, *C. Pepo* and *Cucumis*; Nagpur on *Cucurbitaceae*; Tarn, larva in *M. Charantia*; Meiktila on *Cucurbita pepo*; Mandalay, Pyinmana, Tatkon, on *Cucurbitaceae*; at Talkon frequently found on fruits of *Trichosanthes cucumerina*; 15) *Chaet. caudatus* F., Dehra Dun on grass; Shevaroy Hills; Coimbatore; Bababudin Hells, Mysore Lashio and Tatkon in larval condition in the fruits of *Trichosanthes palmata*; Myitkyina on *Citrus decumana* and at Taung-gyi; 16) *Chaet. garminiae*, Bezzi, bred at Peradeniya from *Garcinia* fruits; 17) *Chaet. scutellariae* n. sp., a single specimen from Goorghalli Estate, South Mysore; 18) *Chaet. biguttatus* sp. nov., a single specimen from Darjiling; 19) *Chaet. bipustulatus* Bezzi, from Mysore and Coonoor; 20) *Chaet. scutellaris*, Bezzi, from Almora; Kumaon; Taung-gyi; 21) *Mellessis sphaeroidalis* sp. nov. a single specimen from Dehra Dun, on grass; 22) *M. brachycera* sp. nov., a single specimen from Dehra Dun, Bhimtal Kumtal; 23) *M. crabroniformis*, Bezzi from Yerkaud, Shevaroy Hills; 24) *M. distillatoria* a single specimen from Bhamo, Burma; 25) *M. eumenoides*, sp. nov. from Tatkon, bred from fruit of *Trichosanthes cucumerina* and one from Myitkyina obtained from cucurbit; 26) *Adrama austeni*, Hendel, one specimen collected at Peradeniya.

The writer also gives a list of the host plants and the species feeding on them.

108 - On a species of *Dibrachys*, a Chalcid Parasite of the "Grain Weevil" (*Calandria granaria*). — BURCKART F., in *Centralblatt für Bakteriologie, Pathologie und Infektionskrankheiten*, Vol. 46, № 22-23, pp. 502-504, Jena, November 1916.

The Author has bred out hymenoptera belonging to the Chalcididae from the weevil *Calandria granaria* kept in breeding cages. SCHMEDE

CHT of Blankenburg identified them as belonging to the genus *Dibrachys* (subfam. *Pteromalinae*) of which three species are known — *D. acutus* Thomson, *D. affinis* Masi and *D. boucheanes* Ratzeburg, but it comes closest to *D. acutus*.

Seen with the naked eye, the body appears black, but microscopic examination shows that it is clearly bluish. The sexes are distinguished by the fact that in the male the abdomen is quite bluish, while in the female it is darker. The colour of the extremities, which is a characteristic of this insect, is brownish-yellow. In addition, shades varying from clear yellow to dark brown can be seen. The study of a single insect is thus sufficient to identify the species from this character alone. The insect is distinguished from *D. acutus* by the fact that the antennae are more pubescent.

The thorax also is strongly hairy. The size and shape of the abdomen is sufficient to permit the unaided eye to separate the two sexes of the insect. In fact, the abdomen of the male is hardly any broader or bigger than the thorax, while the opposite is the case in the female.

No observations were made on the biology of this insect, and the part it plays as a parasite is also unknown. Several parasites of *Calandra granaria* are recorded (*Chremylus rubiginosus* Nees, *Cerocephala cornigera* Estw., *Pteromalus calandreae* Howard, *Meraporus* sp.) to which must be added the *Dibrachys* described by the Author.

1. — *Thersilochus conotracheli*, an Ichneumonid Parasite of the Plum Curculio (*Conotrachelus nenuphar*). — CUSHMAN R. A., in *Journal of Agricultural Research*, Vol. VI, No. 22, pp. 847-855. 9 figs. plate CLIX. Washington, August 28, 1916.

During the seasons of 1914 and 1915, the ichneumon *Thersilochus conotracheli* Riley has been the most abundant and effective parasite of the plum curculio (*Conotrachelus nenuphar*) Herbst at North East, Pa. As far as is known, this ichneumon only attacks the plum curculio, as it has been reared from this host in Connecticut, New York, New Jersey, Pennsylvania, Illinois, Missouri, Kansas, and Michigan.

The parasite is single-brooded, the life cycle of one generation extending over a year. The adult stage is reached in autumn, but the adults do not emerge until late May to the middle of June. The females emerge earlier than the males but live longer than the latter. The curculio larva is usually attacked while still small, from hatching till burrowing into the fruit. The egg deposited in the body of the larva hatches in about 6 days and the newly hatched larva lives as an internal parasite lying free within the body cavity of its host. More than one parasite may be found in a single host, but normally only one is successful. When the parasite is fully grown, it leaves its host and feeds externally on the body of the victim.

Detailed description of the various stages are given, together with illustrations.

It appears from this work that *Thersilochus* does not begin ovipositing until some time after the curculio has begun to attack the fruit, and

therefore does not exercise any control over the early larvae of *Conotrachelus nenuphar*.

9 references are given at the close of the paper in the bibliography.

- 110 - *Prospaltella fasciata* n. sp., a Chalcid Parasite of the Scale Insect *Chrysomphalus dictyospermi*, in Italy (1). -- MALENOTTIETTORE, in *Redia*, Vol. XII, Part 1, pp. 195-196, 1 Fig., Florence, 1916.

A systematic description of *Prospaltella fasciata* n. sp. The Author has collected several females of this hymenopteron, parasitic on the scale insect *Chrysomphalus dictyospermi* living on *Sansevieria arborescens*, in a hot-house in Florence. The male of this chalcid is as yet unknown. The new species approximates to *P. lutea* Masi.

- 111 - A New Remedy for the Successful Control of *Elateridae*. -- STERLIK W., *Blätter für Zuckerrübenbau*, Year 23, No 14, pp. 165-167, Berlin, 1916.

In order to find an efficacious control of these beetles, the Author studied in detail the habits of the larva, and of the adult living on *Umbelliferae*. Contrary to any expectation the insects were found in numerous localities collected together on seeding sugar-beets. The species were those of *Agriotes lineatus* and *A. obscurus*, which were feeding on the pollen. One insect was seen to devour all the pollen of one flower in 10 minutes. The appearance of many of these insects on the seeding sugar-beet provided the opportunity of finding a method based on this fact to destroy the insect. For this purpose a bag was made of waxed cloth so that the interior surface would prevent the insects from climbing. To capture the insect by this means is very easy. The bag is placed below the inflorescence of the beet which is shaken, when the insects fall into the bag. The habit of the beetles in falling from the branches after a slight disturbance considerably helps the operation.

Two persons are needed for the work, one to hold the bag, the other to shake the plant. The work should be carried out in fine weather. By this way about 6 000 beetles were collected in a single day. The sugar beets should be visited at intervals after flowering and capture should be commenced immediately the first insects appear. The operation should be repeated several times at the same places. The beetles sometimes reappear 3 hours after one removal, and then the operation should be repeated.

To apply this method, the seeding plants should be left in the beet fields. According to the writer, in fields badly attacked by these insects it is sufficient to have the seeding plants on small areas only.

- 112 - Diseases and Pests of the Sugar-beet observed in Austria-Hungary, 1915. -- FIALADA O., in *Osterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Part 3, pp. 107-116, Vienna, 1916.

I. ANIMAL PESTS.

Elateridae. -- These voracious larvae, particularly those of *Agriotes lineatus* and *A. obscurus*, have caused great damage, especially in 1915.

(1) See also B. November 1916, No 1245.

districts of central Bohemia. The soil being too wet at sowing-time, it formed a superficial crust and consequently the beets grew slowly and were attacked by the larvae. In northern Bohemia the larvae were reported as injuring the young vegetation, but not more severely than usually; also in southern Moravia. In Silesia, Elaterids were found in large numbers in soil rich in humus; this pest has, however, not appeared in the Hungarian beet-fields.

Melolontha and Rhizotrogus. The larvae of *M. vulgaris* and *R. aquaticus* have appeared in the Sudeten region in smaller numbers than in previous years, as also in Hungary, where the damage caused was insignificant.

Silpha sp. — The larvae of this pest were not numerous, some of the species *S. reticulata* being found in southern Austria. In western Hungary phid larvae were reported at the end of May; the species was probably *atrata*, which had appeared there the year previously.

Cleonus sp. — caused little damage, even in those regions of Hungary it had been badly attacked in previous years.

Haltica sp. — This Coleopteron, together with the Elaters forms one of the worst enemies of the sugar beet, although it was only reported from 3 regions — central Bohemia, eastern Hungary, and southern Hungary. Here, where it appeared at the same time as the Elaters, a second sowing had to be carried out in many cases.

Agrotis segetum. — The larva has caused serious damage to sugar beets in central Bohemia, and also in some districts of western and eastern Hungary. In the other regions of Austria-Hungary insignificant damage was caused.

Lita sp. — An isolated appearance of the larvae of *Lita* devouring beets was recorded towards the end of July from eastern Hungary. Unfortunately it was not possible to study this little known Lepidopteron more thoroughly. It is probably *Lita atriplicella*, living on *Chenopodium* and *triplex*, an insect related to *Lita ocellatella* living on *Beta maritima*. The larva mines the leaves like the following insect.

Anthomyia conformis. — This insect is only recorded from one district of central Bohemia where it is wrongly known as green caterpillar ("Grünraupe").

Aphis papaveris. — This species caused some damage in western Hungary during the first half of June. Beets sown early resist the pest much better than those sown later. The insect was not reported from other regions of the empire.

Other sugar beet pests such as *Gryllotalpa vulgaris*, *Atomaria linearis*, *Scissidula nebulosa*, *Tetranychus telarius*, *Julus* sp. as well as *Athalia spinaria* and *Tipula oleracea*, caused no damage last year.

II. DISEASES.

Root Gangrene. — This disease only occurred in isolated cases. Slightly considerable damage was caused in central Bohemia, but the fine weather made up for the loss. Attacked roots showed the presence

of *Phoma betae* which had probably been transmitted to the roots by the soil.

Heart rot and dry rot. — The above mentioned beets whose roots were attacked by *Phoma betae*, showed blackened heart-leaves at the same time (end of May) and as microscopic examination showed the presence of *Phoma* it was concluded that the heart leaves were also attacked. Heart-rot usually only appears at the end of July to the beginning of August. It was observed that the climate was probably unfavourable to the spread of the fungus, for attacked plants gradually recovered. In July, beets of tardy development as well as many of normal development showed attacked external leaves.

The edges of the leaves were less developed, while the colour had become paler, and the plants seemed to be suffering from nitrogen-starvation. The cause was probably of a physiological or nutritive character due to the disease attacking young plants. This seems to be confirmed by the freedom of the diseased leaves from parasites while the roots were also healthy. It is further observed that diseased roots that were big were heavier and with a greater sugar content than healthy-roots. The ratio $\frac{\text{roots}}{\text{leaves}} = \frac{1}{1.3}$ shows a certain precocity in diseased beets which may also be a sign of lack of nitrogen.

Other diseases were not observed by the Author in 1915.

113 - **Injuries to Seed-producing Tea Plantations, in Java.** — BERNARD CH., in *Mededeelingen van het Proefstation voor Thee*, No XXXIX, pp. 1-24, 3 Pl. Buitenzorg, 1915.

In the first chapter the Author translates the report of a voyage by Mr. A. S. TUNSTALL in Cachar and Sylhet in order to study seed-producing tea-plantations.

Another chapter gives some observations made by the Author in Java.

A description is given of the renovation of a plantation intended for the production of seed, which, after producing normally for 25 years, hardly produced any normal seeds. As all remedies appeared useless, it was decided, after a few preliminary trials, to cut down the trees to a foot above the ground, after which new stalks appeared, 4 of which were retained for future development. In the same paper, a case is mentioned where a scale-insect belonging to the *Monophlebinae* was attacking the roots of the tea plant; the insect is particularly injurious to the rootlets.

It is advised, in order to avoid the damage that *Adrama determinata* (1) causes to the seed, to collect all the seed that has fallen to the ground. After sorting in water, they can be preserved in boxes out of the way of the parasite, if not required immediately for sowing.

114 - ***Metamasius ritchiei* n. sp., a Coleopteron Injurious to the Pineapple in Jamaica.** — MARSHALL GUY A. K., in *Bulletin of Entomological Research*, Vol. V.1, Part 1, pp. 197-198, 1 fig. London, 1916.

Systematic description of *Metamasius ritchiei* n. sp. (sub-fam. *Calyndrininae*). According to information supplied by Mr. A. H. RITCHIE, entomologist

(1) See B. August 1915, No 877.

ogist to the Government of Jamaica, these insects appeared in the Rocks district about four years ago, and their number has continually increased.

They principally damage the shoots that develop on the underground parts of the pineapple, and which finally form a root system independent of that of the mother plant ("ratoon pines").

The plants may be attacked in various points; the fruit is particularly hosen.

In 1916, the insect caused a loss of 75 per cent. of the crop.

Besides *M. ritchiei*, many specimens of *M. sericeus* Oliv. have been seen, but according to MR. RITCHIE, the presence of this second species is only of secondary importance in the present case.

15 - **On Species of Tripanellidae (Diptera), Genus *Carpomyia* Injurious to the Fruits of *Zizyphus*.** — SILVESTRI F. in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XI, pp. 170-182, fig. 1-IX. Portici, 1916.

The genus *Carpomyia* Rond. includes two species of very wide geographical distribution, one of which *C. vesuviana* A. Costa, occurs in Southern Italy, Dalmatia and Southern India and the other in Southern Italy, Egypt and Eritrea. These two species pass their larval stage in the fruits of certain species of *Zizyphus* viz: *Z. sativa* in Italy (*C. vesuviana* and *C. incompleta*), *Juinba* in India (*C. vesuviana*), *Z. Spinacristi* in Eritrea (*C. incompleta*).

In 1910 Bezzi undertook the systematic classification of the genus, and is now redesccribing the two species. The present writer now describes the larvae of these species for the first time and gives a new description of the adults accompanied by figures and biological notes.

As natural enemies of *C. vesuviana* are noted: an ectophagous parasite of the larva, *Bracon fletcheri* Silv., and an endophagous parasite which emerges from the pupae, *Biosteres carpomyiae* Silv., both obtained in India by B. Fletcher.

From *B. carpomyiae*, the writer has obtained, from the 20th to the 25th September, 5 specimens emerged from pupae of *Carpomyia* forwarded from India in February.

The writer has not succeeded in obtaining in Italy a single endophagous parasite of the larvae or pupae of *C. incompleta*, but only a few specimens of *Eupelmus urozonus*, a Chalcid ectophagous parasite of numerous other insects, among which *Dacus oleae*. From the pupae of *C. incompleta* collected at Cheren (Eritrea) in February 1914, a fair number of specimens of *Opus concolor* Szepi. were obtained, and, from a pupa, two females of a *Tetrastichus* slightly differing from the female of *T. giffardianus* Silv. While awaiting the identification of the male of this *Tetrastichus*, the author reserves the question of its determination open.

- ***Lecanium capreae*, a Scale Insect Injurious to *Robinia* Plantations, in the Province of Ekaterinoslav (Russia).** — КОЛЕСНИКОВЪ АЛЕКСАНДРЪ (KOLESNIKOV ALEXANDER), in *Сельское хозяйство и Лесное хозяйство (Agriculture and Silviculture)*, Vol. CCLI, Year LXXVI, pp. 104-205. Petrograd, 1916.

In describing the present state of the *Robinia* plantations in the Circle of Komisarovsk of the Forest Region of Verchnednieprovsk (province of

Ekaterinoslav), the author calls attention to a scale-insect recorded from 1908-1909 onwards on the young stems and branches of the *Robinia*, thus showing the error of the common idea that this plant was almost immune from insect attack. The parts attacked dry up from the tip downwards, so that the young plant dies. The most serious injury was found in 5-7 year-old plantations; the insect is rarely seen on plants over 10 years old. In places where the pest was very numerous, it was also recorded on *Eucalyptus europaeus*.

According to the identification by the Entomological Branch of the Forests Department, the pest is *Lecanium capreae*. Under the large shield of the female are found the eggs, from which the young emerge about mid-summer (July) and spread in all directions. Towards winter, the scale-insects fix themselves in previously chosen spots and commence development; they only attain full growth in April.

When the shield is formed, the female commences oviposition and by May has laid 2 000 eggs.

The female then dies, and the scale, remaining behind, serves to protect the eggs from injury.

